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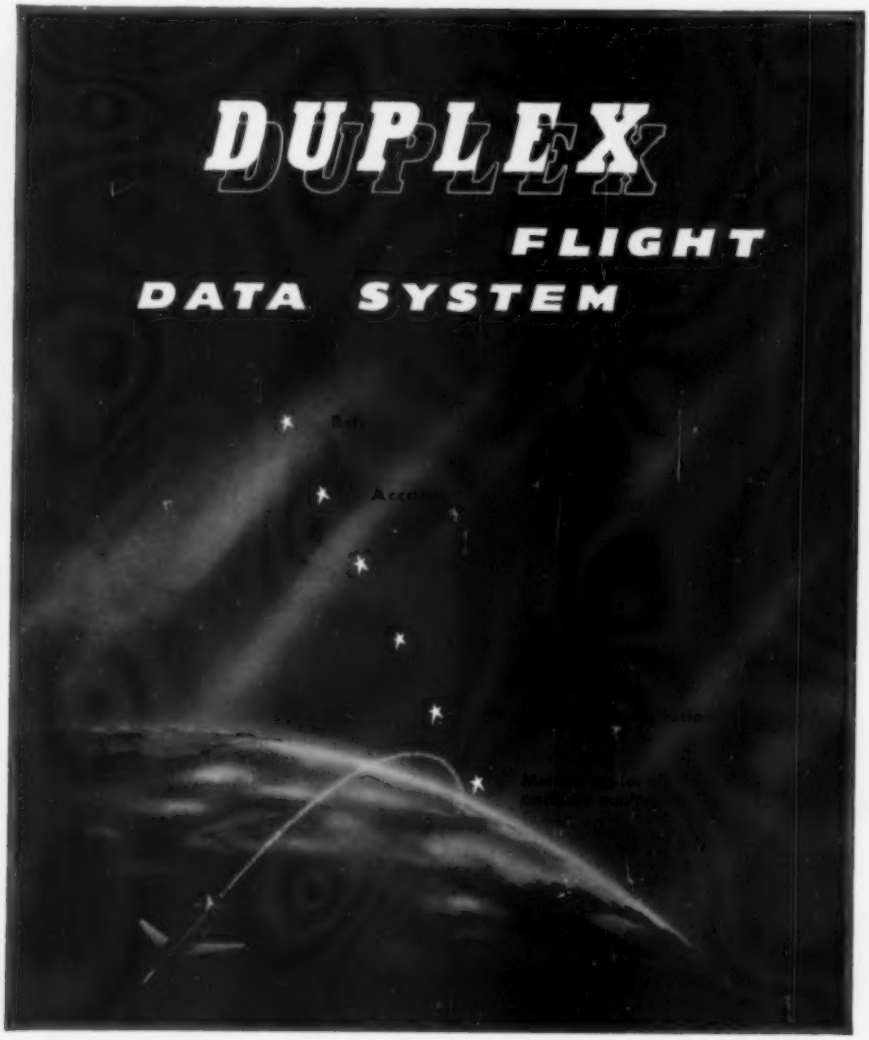

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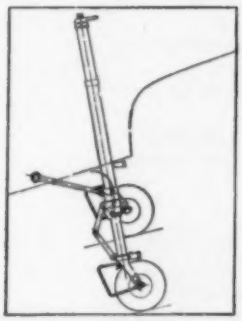

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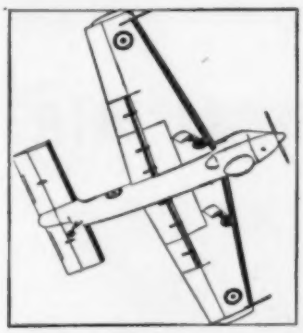

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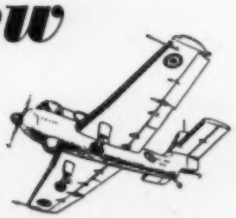

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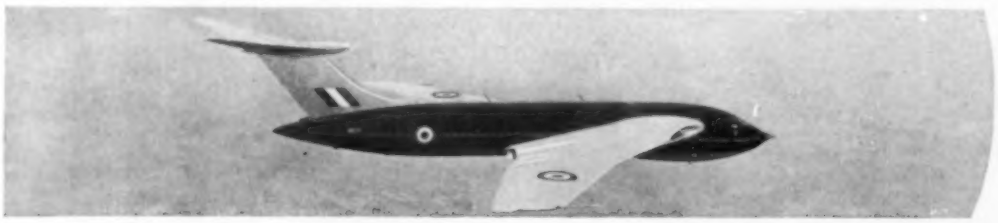

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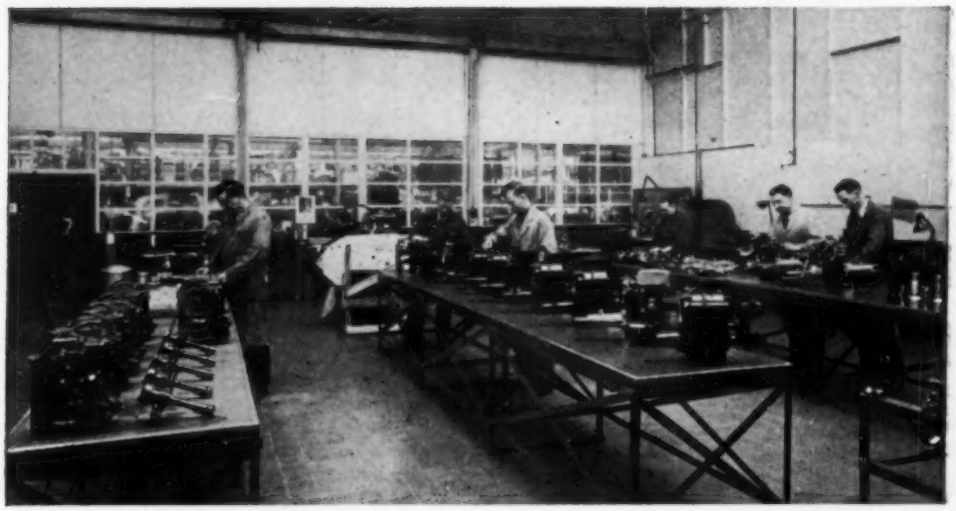

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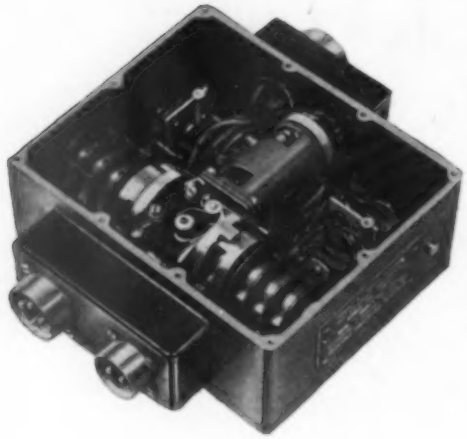

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Business Aircraft can Pay their Way

THE numbers of pilots and private aircraft per head of population in various countries are officially published from time to time, but we seldom have the heart to quote them, so poorly do figures for the British Isles compare. The reasons for this regrettable state of affairs—weather, reduced incomes, taxes, size of country, and alternative well-developed forms of transport—offer little comfort. The day of the small, cheap helicopter may come sooner than many people think—and alter the picture.

Here we propose to discuss the one-size-larger aircraft—the business machine, which, though still comparatively rare in this country, is now being employed in slowly increasing numbers. While small single-engined aircraft are doing a good deal of useful, remunerative flying they are not the real answer to the requirement of the business organization.

In amplification of our opening remarks, it is pertinent to quote some American figures—for a population about four times that of Great Britain. For example, size, affluence and weather almost certainly account for the fact that, among the various states, California and Texas have by far the most civil aircraft: the figures for the last complete year are, respectively, 10,067 and 6,581. Illinois comes third with under 5,000 aircraft.

American official figures are broken down to indicate the total numbers of aircraft miles and hours flown for business as opposed to agriculture, instruction, hire and sport. For 1951 the business total was over 309 million miles in 3m hours (for agriculture 146 million miles were flown). At the end of 1953, 10,000 aircraft, of which nearly 2,000 were multi-engined, were flying on business duties as compared with approximately 1,050 on scheduled airline services. Their 3¼m passenger hours were flown with a remarkable safety record of 0.5 fatalities per 100 million miles. This compares well with the best results achieved by the major airlines.

The total of aircraft on the current British Register which are used for business and private flying and which hold current Certificates of Airworthiness is less than 400, and the majority are single-engined. Independent operators and charter companies, many of whom have regular business contracts, add about 350 more.

In Europe, with its congested air zones and lanes, its poor flying weather and its sea crossings, only a well-equipped twin- or multi-engined aircraft can be operated with the regularity and safety essential for business purposes. A variety of such aircraft is, in fact, used, including Dove, Prince, Anson, Expeditor, Bobcat, Rapide and Gipsy-Gemini.

Operators with whom we have talked not only confirm the utility and convenience of having an aircraft at home or abroad but also agree that, generally, more work is found for an aircraft than was foreseen at the time of its purchase. *Flight* can confirm this from personal experience. The only limit to our own Gemini's usefulness is in the hours which members of the staff can afford to spend at its controls on our own behalf and for our associated journals. We do not employ a professional pilot.

A Gemini fitted with Gipsy Major engines to give single-engined safety is perhaps the smallest aircraft qualifying for inclusion in the European business category. With V.H.F. and a radio compass or equivalent aid it can reasonably be flown under all normal conditions by night or by day. A similar machine is the Miles Aries, the first of which recently flew successfully to Australia, as recorded on page 75.

In considering the cost of operating a business aircraft, it is difficult accurately to assess the value to an executive of the additional convenience and the time saved. Nevertheless, it has been the experience of more than one business operator that two or three journeys to keep unexpected appointments which could not have been undertaken in any other way have by their results covered the operating cost of the aircraft for the year. Every potential user has to consider his own individual case—and costs and returns of this sort cannot very well be treated generally.

It is our belief that a number of British and European business organizations would find that an aircraft could not only earn its keep in their employ but could also facilitate travel and open up new possibilities, economical in time and cost, for personal representation and attendance at meetings, exhibitions and other functions. If some companies in the world go so far as to describe their executive aircraft as "indispensable" it is reasonable to suppose that many others might at least find a privately owned aircraft well worth while.

FROM ALL QUARTERS

REMODELLED in detail is WG240, the "semi-navalized" D.H.110, prototype of a new, folding-wing, all-weather fighter for the Fleet Air Arm. Points to notice are the all-moving tailplane, in place of the normal combination of fixed tailplane and movable elevator (the 110 is the first British aircraft to fly with this device); revised shape of the "keel" surfaces beneath the fins and rudders; and extended-chord leading-edge outboard of the wing fences. During its second flight with the new tail—on June 14th last—the 110 again exceeded the speed of sound.

The Lords Discuss Noise

THAT the Air Navigation (Seventh Amendment) Order, 1954—which exempts manufacturers' airfields from lawsuits in respect of disturbance through noise and vibration—must be accepted as a necessary evil "in the national interest" seemed the general view of those taking part in a short House of Lords debate on the subject last week.

Points raised during the debate—apart from general consideration of the curtailment of Common Law rights to the private citizen—included a complaint by Lord Ogmore that the sum of £100,000 to be spent by the Ministry of Supply on noise research was "a fleabite," and a suggestion by Lord Balfour of Inchrye that an advisory committee be set up by the Minister to inquire whether everything possible had been done by any manufacturer about whose operations complaint had been made on the score of noise.

In replying for the Government, Lord Hawke explained that the immediate reason for the Order was the recent experience at Dunsfold, where the Hawker Hunter is produced and where a local resident had sued the firm on account of the noise they were causing. When the case was settled out of court there came the immediate possibility, if not probability, that similar action would be taken by other people living near to this or any other airfield.

The danger was not so much of damages but of an interim injuction which might paralyse an airfield and deliver a crippling blow at our defence programme and exports while the case was being decided. It had accordingly been decided to introduce the Order as the most effective and appropriate solution to the problem. It had the effect of bringing 22 unlicensed aerodromes into the same fold as 270 active aerodromes, both Government and civil, which were already exempted from any lawsuits in respect of noise and vibration under the Civil Aviation Act, 1949.

Lord Hawke went on to emphasize the difficulty of prescribing conditions under which noise and vibration might be caused and said it was thought best, in the first place, to rely on the co-operation of industry, knowing that a great deal of research, both on Government and on private account, was being carried on into this question of jet noise.

In this connection he said that the Ministry of Supply had now placed orders for four mufflers—two for single-engined aircraft and the others for multi-engined types. A large sum of money was also being spent by firms, universities, and research institutions in addition to the £100,000 allocated by the Ministry for noise research. [See *Flight*, July 9th.]

Lord Hawke then mentioned a recent visit to Dunsfold where he had experienced at first hand the noise effect of engine testing of Hunters. It seemed to him that the noise was most intense at a position which he could best describe as being that of third man and long leg if the nose of the engine was facing the bowler.

This analogy amused their Lordships vastly, although they did not fail to note that Lord Hawke, as reserve bat for the Government, was caught out rather dismally by Lord Balfour of Inchrye on the question of Redhill airfield, and its liability under the Order.

We trust that a more complete appraisal of the situation will be offered by the Minister of Transport of Civil Aviation in the House of Commons this week when, it is expected, a similar debate will be held.

Princess Margaret in Germany

ON Tuesday last, July 13th, Princess Margaret was due to present a Squadron Standard to No. 20 Sqn. at R.A.F. Station Oldenburg, Germany, during a four-day tour of Service units. She flew out in a Viking of the Queen's Flight on Monday; an earlier plan for Her Royal Highness to make the journey by helicopter had to be changed owing to weather.

Squadron Standards are given in recognition of 25 years or more total service. No. 20, which is commanded by S/L. I MacDonald, A.F.C., has chosen the following Battle Honours for commemoration on the scrolls of its Standard: Somme, 1916—Arras-Ypres, 1917—Somme, 1918—North Burma, 1943-44—Arakan, 1943-44—Manipur, 1944—Burma, 1944-45.

Back and Forth

FROM a number of C-47 Dakotas purchased from America in 1946 the R.A.F. has now released 50 as surplus for military service elsewhere. They are to be reconditioned at American expense in Britain, and then returned to the U.S. Government as a gift. An assurance was given at the time of the original purchase that the aircraft would not be released for civilian use, and the Americans have now stated that they will be re-allocated within the framework of the NATO air forces.

AIRBORNE: The Douglas company got two important new prototypes airborne within a week at Edwards A.F.B., California, recently: the Navy A4D Skyhawk (above) and the Air Force RB-66A (left), on June 22nd and 28th respectively.

Future of the Big Boats

LAST week the Princess flying-boat G-ALUN was pulled out of the water at Cowes, and there was a rumour that she was shortly to be Cocooned and join her two sisters in storage at Calshot Spit, Southampton Water. A subsequent statement by Saunders-Roe Ltd., said that the company was now awaiting Ministry of Supply instructions as to whether the aircraft should be stored until such time as more powerful engines are available.

G-ALUN, the first Princess to be built and the only one to have been flown, has completed a limited test programme of some 100 hours in the air.

Last week's reports suggest that, despite the interest shown in the Princesses by both B.O.A.C. and Aquila Airways towards the end of last year (*Flight*, November 13th), no encouraging developments may be expected for some time to come. The final verdict on the ultimate use of the three boats will continue to rest with the Ministry of Supply. The Saunders-Roe spokesman said last week that the company was convinced that flying-boats had a big future ahead of them and that the Princesses boats had a big future, and that the Princesses were the only aircraft capable of being fitted with nuclear propulsion systems.

Anglo-Russian Exchange by Air

THE first post-war student-exchange scheme between Russia and this country was due to begin yesterday, July 15th, with the departure from Bovingdon of 30 British students in a Hunting-Clan Viking, bound for Prague. From the Czechoslovak capital they were to continue to Moscow in an Aeroflot machine, which had brought the party of Russian students from Moscow, while the Viking completed the Russians' journey to London.

The return flights are to be made on August 3rd. During the exchange, organized in this country by the National Union of Students and the Wayfarers Travel Agency, comprehensive itineraries have been planned in both countries.

Exercise "Dividend" Begins

THE major United Kingdom air defence exercise for 1954, code-named Dividend, is being mounted in two phases, from 2000 hr today, July 16th, to 1800 hr on July 18th and from 1500 hr on July 22nd to 1800 hr on July 25th. A very large number of aircraft from all United Kingdom Commands will be taking part in every type of defence and attack operation, nearly 1,000 aircraft being employed as the "enemy." Efforts are being made to render the latter visually distinguishable from the defending forces. The defences will be directed from Fighter Command H.Q. by the A.O.C-in-C., Air Marshal Sir Dermot Boyle.

Since both phases have been arranged to include a week-end the Auxiliary squadrons all over the country will play their part alongside the regular squadrons. Anti-aircraft Command and units of the Royal Observer Corps will also be fully engaged.

Contemporaneous with Dividend there will be two other major exercises, Haul and Winch. The former is a NATO Channel minesweeping and patrol exercise while Winch will involve the operation of a British beach brigade in a landing scheme on the Belgian coast. A Notice to Airmen (No. 408/1954) gives details of the exercise area and the special Air Traffic Control regulations which will apply throughout the period between July 16th and 25th, when either Dividend or Haul, or both, will be in progress.

Wright Jubilee Trophy

PRESENTED last year by the Royal Air Forces Association to the Air Council, the Wright Jubilee Trophy is to be competed for at the Central Flying School, Little Rissington, on Thursday, July 22nd.

The competition will take the form of an aerobatic contest between selected flying instructors from the jet Flying Training Schools and the R.A.F. College, Cranwell. A panel of judges will be drawn from the C.F.S. supervisory staff and will include the Chief Instructor, W/C. F. L. Dodd, D.S.O., D.F.C., A.F.C.

Aircraft taking part will be Meteors and Vampires and each pilot will be required to execute a loop, slow roll, roll off the top of a loop, eight-point hesitation roll and vertical roll. In addition, each competitor is allowed two minutes in which to carry out a manœuvre of his own choice.

The winner will be announced shortly after the end of the competition, but the trophy will not be presented until December 17th, the next anniversary of the Wright brothers' first flight.

A High-Altitude Bisley

WHAT is claimed to have been the world's first rocket target-shooting meeting was held early this month at Yuma, Arizona. Both F-94C Starfire and F-86D Sabre teams from the defence commands of the U.S.A.F. took part. Each aircraft carried 24 × 2.75in rockets which it fired entirely under radar control at a 45ft-long sleeve towed by a jet bomber. Each team flew 24 sorties, half at 30,000ft and half at 20,000ft. Both types of fighter which competed are fitted with automatic lock-on radar and weapon-discharge gear. The winners were the Crew Training Air Force team from Moody, A.F.B., Georgia, who flew Starfires.

Norway's Air Strength

IN an interview with the newspaper *Bergens Tidende*, Maj-Gen. E. T. Johnsen, Chief of Staff of the Royal Norwegian Air Force, says, "The Air Force has never been as strong as it is today. We have now achieved the strength as laid down by Parliament: Seven fighter squadrons and a transport squadron. By the end of the year we expect to have a wing of maritime aircraft, and a photo-reconnaissance wing will be ready in the first quarter of next year. In the next few months we expect to start using a number of new radar stations, and in the course of the summer and autumn we will be opening a great number of radio communication lines."

"Balloon-Burst" Wind Tunnel

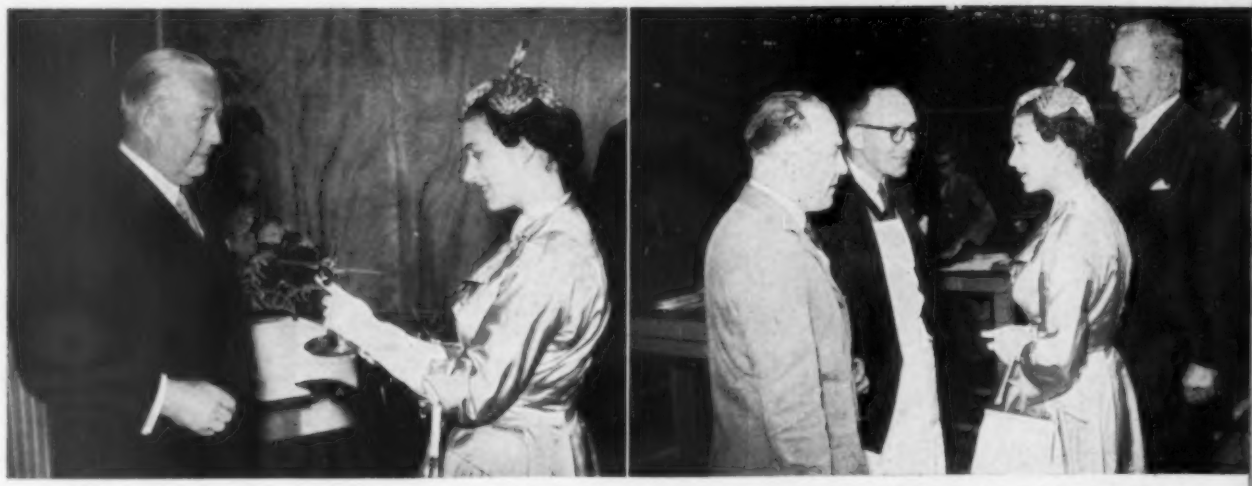
THE use of a new type of intermittent wind tunnel at the Aeronautical Engineering Laboratories of the Massachusetts Institute of Technology was reported recently. The new tunnel, or "shock tube," is the property of the U.S.A.F. and is now being used under a contract with the Air Research and Development Command, Wright Field, Dayton. It is being operated under the direction of Professor Raymond L. Bisplinghoff and Professor H. Guyford Stever.

The tube consists of a tunnel 98ft long, more than a foot square and constructed of $\frac{1}{4}$in steel plate. In the centre is a diaphragm section where a sheet of film divides the tube into two sections. After the film has been inserted a compressor builds up air pressure in one end of the tube, and a pump can be used to reduce pressure in the other end, where the model under test is mounted. When the appropriate air-pressure conditions have been set up a remote control knife cuts the film, the compressed air is released, and a shock wave moves rapidly along the tube towards the model. After the passage of the shock wave the model is in a steady high speed airflow for approximately 0.04 of a second.

With electronically timed high-speed photography, engineers can photograph the model at any instant during the test. In a series of tests, such photographs can be used to show all stages of a shock passing the model, or of the model in established transonic or supersonic flow.

The new equipment is stated to be an engineering tool intended for use with engineering studies of aircraft construction as well as in purely scientific studies of shock waves. It forms part of the facilities of "Project Locus" at M.I.T.—a study by the Aeronautical Engineering Department of the effects of bomb blasts on flying aircraft. As mentioned, it can also be used as a short duration wind tunnel, for speeds up to M = 1.5, for which purpose the new shock-tube is much more economical than conventional types of wind tunnel.

PRE-FLIGHT preparation of the Comet 3 was reaching a climax as this issue went to press. The new prototype was first wheeled from its hangar on May 4th for initial engine-running. This picture, taken at Hatfield on July 7th, shows the completed aircraft on tow between the experimental shop and the new flight hangar, where it was weighed.



GRACIOUS VISITOR: These pleasant photographs, taken during Princess Margaret's recent visit to the factory of Hawker Aircraft (Blackpool) Ltd., show Her Royal Highness with Sir Frank Spriggs and (right) in interested conversation with employees while accompanied by Mr. E. H. Jefferson.

FROM ALL QUARTERS . . .

Danish and Swedish Hunters

NEGOTIATIONS between Hawker Aircraft, Ltd., and the Danish Government for the supply of Hunter jet fighters to the value of £3,000,000 were finally completed on the afternoon of July 6th, and all the aircraft involved should be delivered to Denmark within the next two years. This is not, of course, the first Hunter contract from overseas, for Hawkers already have on their books NATO orders worth $182m (£65m) for Hunters to be built in the United Kingdom, Holland and Belgium.

Less than 24 hours after the announcement of the Danish order came news of a £12-million order from Sweden—the outcome of negotiations which have extended over the past six months. Again, deliveries are expected to be spread over two years. The new Scandinavian orders follow Ministry of Supply clearance—on June 24th—for delivery of Hunters to the R.A.F.

"Little Farnborough" in Germany

FOR the benefit of military and technical representatives of the European Defence Community Interim Commission, an exhibition of British military aircraft was put on at Wahn airfield, near Bonn, on July 7th. It was presented by the S.B.A.C. under the sponsorship of Her Majesty's Government, and representatives of the E.D.C. were afforded an opportunity of studying in more detail some of the machines they saw in flight at Farnborough last September, and which, it was considered, might be of interest to them in their work of planning the equipment of future European defence forces. Spectators numbered about a hundred and included Herr Theodor Blank, head of the German delegation for the organization of European defence, General Heusinger, and a group of specialists from the Federal German Defence Office. Mr. Nigel Birch, Parliamentary Secretary to the Ministry of Defence, acted as host.

Drawn up on the tarmac for static exhibition (there was no flying) were examples of the following aircraft: Armstrong Whitworth (Gloster) Meteor N.F.14; Auster Aiglet Trainer; de Havilland Chipmunk T.10, Vampire Trainer and Venom F.B.1; de Havilland Canada Beaver 2; English Electric Canberra P.R.7; Handley Page Navigational Trainer (Marathon); Hawker Hunter F.1 and F.2; Hunting Percival Pembroke C.1 and Provost T.1; Saunders-Roe Skeeter; Scottish Aviation Prestwick Pioneer; Short Seamew A.S.1; Vickers-Supermarine Swift F.3; Westland Whirlwind.

After a display the guests attended a reception in the officers' mess at R.A.F. Station Wahn.

Comet False Alarm

A NUMBER of local residents telephoned de Havillands at Hatfield on July 8th saying that they had seen a Comet over Hertfordshire trailing smoke and apparently on fire. The true nature of the "smoke," it transpired, was water ballast which was being jettisoned. The aircraft, a Comet 2, had taken off from Hatfield loaded to full all-up weight with water ballast in the course of routine C. of A. tests. Before it could land again the ballast had to be jettisoned to reduce weight.

The company later explained that the ballast jettisoning was a routine operation and that the aircraft, piloted by G/C. John Cunningham, was carrying out certification tests entirely unconnected with investigations into the Comet 1 accidents. These tests, after a lapse of a few weeks, are now being continued as part of the normal programme for obtaining a C. of A. for Comet 2s.

FIRST OUTING: Taken during the period of initial test flights at Luton, these snaps show the Percival Jet Provost in its bare state. The close-up reveals such details as nosewheel design, boundary layer bleed in the air intake, and the step provided on top of the intake. When, soon, it re-emerges, this prototype will be painted and complete with markings. Being the first basic jet trainer to fly—it is powered by an Armstrong Siddeley Viper ASV.5 producing 1,640 lb thrust—the Jet Provost has aroused interest all over the world.

PRESENTATION DAY AT CRANFIELD

Sir Victor Goddard Completes Three-year Term as College of Aeronautics Principal

THE award of diplomas in aeronautical science to 53 post-graduate students on Friday last marked the completion of the seventh two-year course at the College of Aeronautics, Cranfield. On this occasion, news was given of the forthcoming departure of the Principal, Sir Victor Goddard; of the establishment of a new lectureship in industrial engineering sponsored by the Mutual Security organization; and of the formation of additional committees in order to bring the governors into closer touch with the College.

Sir R. Victor Goddard, K.C.B., C.B.E., M.A.

In his report, Sir Victor Goddard first welcomed Sir James Helmore (Permanent Secretary to the Ministry of Supply), who, deputizing for the Minister himself, was to present the diplomas. Sir Victor went on to express thanks "to the staff of the college, for their devotion and creative enterprise; to the students, for their painstaking and lively co-operativeness; to the governors, for their continuing pursuit of the well-being and the objectives of the college, their support for the many difficult and complicated projects that are put to them, and their unremunerated efforts to guide and develop the college; and finally to the Ministries of Education, of Works and of Supply, and to the aircraft industry, for their many services."

The Principal continued, "If I may add a personal note, I would say that I have deeply appreciated the opportunity I have had for sharing in this great enterprise. While still serving in the Royal Air Force, I was invited to follow on, where my distinguished predecessor Mr. Relf left off, to preside for a few years over the growth of the college in numbers, activities and public esteem. Those few years have passed all too quickly. It may be thought that it would have been of greater service to the college had I elected to remain Principal while a full-time successor was found to take my place, but I believe that it is best that the post should be seen to be vacant so that no man of eminence who might be invited to have the honour that I have had should feel compunction about being the cause of my going. Meanwhile I am sincerely glad that the responsibilities of Principal are to be held temporarily by Mr. B. W. A. Dickson who, as one of the deputy chairmen of the board of governors, has won both confidence and affection . . ."

The concluding part of Sir Victor's speech referred to the graduating students: "The men who will shortly present themselves for their hard-won awards are the men who, with others who went before and come after, will make the college stable in the way that matters most. . . Longevity is not one of my ambitions so I shall hope that one of them will not take too long in qualifying for appointment to the post of Principal! A few years after that happens the College will, I think, have become its real self. I hope to see it then."

The chairman of the board of governors, Sir Frederick Handley Page, spoke next. He described how, to bring the governors into closer touch with the work of the College, three additional committees had been appointed during the year. They dealt with education, finance and establishments, and administration respectively, and their respective chairmen were Sir Ben Lockspeiser, Sir Reginald Verdon Smith and Mr. B. W. A. Dickson, who had each been appointed deputy chairmen of the main board.

The chairman then referred to the departure of the Principal at the end of the academic year on completion of his three-year appointment. "During his term of office," Sir Frederick said, "Sir Victor has made the excellent work of the College well known to many important people outside who were entirely ignorant about it and had not grasped the significance of the place of the College in the teaching of technology." The College was also sorry to lose Professor Young to Queen Mary College.

After mentioning the planned expansion of the aircraft electrical section and the success of the Work Study School, the chairman announced in conclusion that a gift of £50,000 from the U.S.A., under the Mutual Security organization, had been received for the establishment of a lectureship in industrial engineering, to which Mr. W. H. Walker had been appointed.

After presenting the diplomas and prizes, Sir James Helmore emphasized in his address that the Ministry of Supply was extremely interested in the products—both men and research work—of Cranfield. The nine M.o.S. research contracts at present being followed at the College included investigations into the use of freon in wind tunnels, and the problem of jet noise.

The vote of thanks to Sir James Helmore was expressed by the vice-chairman of the board, Sir Harold Roxbee-Cox.

In the list of awards which follows, the subject of each graduating students' thesis is indicated:—

DIPLOMAS WITH DISTINCTION

Aerodynamics.—J. B. Gilder, B.Sc.(Eng.): Effect of a tailplane on the longitudinal stability of a helicopter; R. D. Milne, B.Sc.(Eng.): Flutter of wings of low aspect-ratio; J. Sandford, B.Sc.(Eng.): A review of existing theories of the compressible turbulent boundary layer; F. G. Willox, B.Sc.(Eng.): Optimum configuration for a given supersonic aircraft.

Aircraft Design.—Lt. La V. W. Brown, Jr., B.S.(Elect.Eng.), U.S.N.: Problems associated with stress diffusion in the vicinity of chordwise cut-outs in the wing; A. E. Heiba, B.Sc.(Mech.Eng.): Vibration characteristics of a cantilever plate with swept-back leading edge; Lt. (E) C. Preston, R.N.: Bearings under high pressure at low rotational speeds.

Aircraft Propulsion.—F/L. E. T. Curran, B.Sc.(Eng.): Secondary combustion in fast-moving airstreams; S/L. H. J. M. Londeau, B.A.Sc., R.C.A.F.: Scaling of combustion-chamber test results; S/L. I. T. A. Murchie: Inert-gas generation for purging fuel tanks; Lt. (E) R. G. Price, R.N.: Heat transfer in rocket tubes.

Aircraft Economics and Production.—C. J. Norbury: Application of memo-motion to industrial operation.

Aircraft Electrical Engineering.—F/L. F. Mobey, B.Sc.(Met.): Corrosion of silver-tungsten contact materials under tropical conditions.

DIPLOMAS

Aerodynamics.—G. A. Cropper, B.Sc.(Eng.): Use of fixed wings to reduce disc loading; G. T. Downer: Effect of wing plan-form on the longitudinal stability of a supersonic aircraft; R. B. Erb., B.Sc.(Eng.): Effect of conduction of heat within a body on temperature distribution and rate of heat-transfer; R. C. Hastings, B.Sc.(Eng.): Forces on yawed bodies of revolution; G. W. Haynes: Wave-drag of swept untapered wings of arbitrary section; G. D. O. Humphreys, B.Sc.(Eng.): Development of sections for non-lifting wings, swept behind the Mach lines, having a minimum wave-drag; G. A. C. Searle: Choice of wing plan-form and section for high-speed commercial aircraft; Lt-Cdr. D. G. Turnbull, M.A.: Flight-testing methods for estimating stability characteristics for supersonic aircraft.

Aircraft Design.—J. A. H. Bailie: Theoretical and experimental investigation into stress distribution in a swept-back multi-web wing; N. A. Barfield: Investigation of output circuit damping and impedance testing of a particular hydraulic-powered flying-control system; W. Brookes: Buckling in compression of curved panels of honeycomb sandwich construction; F/L. G. R. D. Calder: Stress distribution in a cantilever plate; F/L. S. Chennakeshu, B.Sc., I.A.F.: Accuracy of the photo-elastic stress-coat technique; G. Davies: Flight resonance testing—a technique of investigation; D. A. Drane: Buckling of thin, unstiffened circular cylinders under pure bending; P. G. Hardie-Bick, B.A.: Root constraint in a swept wing with ribs parallel to line of flight; F. E. Jarlett: Pure bending tests on a series of multi-cell beams; E. J. Phillips: An investigation of a tapered box beam.

Aircraft Propulsion.—P. N. Dent, B.Sc.(Eng.): Three-dimensional flow investigations, using a water compressor; C. T. Ebel: Studies of turbojet control system; P. W. Hill: Performance of "reversed-intake" supersonic exhaust nozzle; F. G. Maccabee: Compressor-blade vibration; J. Rousseau, B.Sc.A.: Heat transfer with boundary-layer cooling; J. H. Sargeant: Causes of unstable combustion; J. P. Spillane: Development of an analogue computor for gas-turbine performance analysis; Maj. W. R. Stephens, B.S.(Aero. Eng.), U.S.A.F.: Design and application of expendable turbojet engines; T. V. Vareed, B.A., B.Sc.(Eng.): Pressure expulsion of fluids from fuel tanks; D. C. Withers: Performance of fuels for ramjets with reference to altitude conditions.

Aircraft Economics and Production.—A. A. A. Abdin, B.Sc.(Mech. Eng.): Critical survey of cutting theory; D. H. Blyther: Effect of heat treatment on magnetic properties of an iron-cobalt-vanadium alloy; B. Butterfield: Machinability of Nimonic 90; D. Fletcher: Manufacture of unsymmetrical integral structures; J. T. D. Holt: Machining characteristics of a Titanium 150A forging, using single-point carbide-tipped tools; J. Jagaciak: Effect of subsonic and sonic vibrations during solidification on the mechanical properties of turbine blades cast in H.R. Crown Max. and Nimonic C.75; R. N. Kashyap: Economic aspects of materials-handling in industry; Lt. H. S. Kennedy, B.S.(Aero.Eng.), U.S.N.: Development of creep-testing machines for spheroidal graphite cast iron; K. G. Lane: Batch-ordering quantities in the aircraft industry.

Aircraft Electrical Engineering.—F/L. P. R. Graham, B.Eng.(Aero.), R.A.A.F.: Measurement and improvement of performance of a drag-cup generator; P. A. Harper: Development of a self-balancing Wheatstone bridge system for a 600-channel strain-recorder; J. W. Tuson: A synthetic trainer for hyperbolic navigation.

PRIZES

Governors' prize, S/L. I. T. A. Murchie; Principal's prize, C. J. Norbury; Senate prize, Lt. La V. W. Brown, Jr., U.S.N.; Woods of Colchester prize (Aerodynamics), R. D. Milne; Woods of Colchester prize (Aircraft Electricity), F/L. F. Mobey.

NAVAL AIR DAY AT BRAWDY

A VERY large number of spectators attended the Naval Air Day at Royal Naval Air Station Brawdy (H.M.S. *Goldcrest*) in Wales, last Saturday. Ten thousand people were present last year, for the first display since the station was reopened, but this year there were between 32,000 and 35,000—and cars still arriving at 4.30 p.m. had to be turned away. The display they came to see was well up to the standard one has come to expect of the Fleet Air Arm, both in the static park and in the air.

The weather was not at its best, but with a 3,000ft cloud-base and some 15 miles' visibility the programme was carried through according to plan. A Meteor 7 opened the proceedings by towing a banner announcing the station's welcome to the audience. Then three Sea Venoms from the recently formed No. 890 Sqn, led by Lt-Cdr. A. Gordon-Johnson, gave a demonstration of formation flying, making their last "pass" with white trails of jettisoned fuel streaming from their tip-tanks. A Sabre from North Luffenham piloted by F/L. Moore came to dispel the mist (metaphorically speaking) with a sonic bang which, though it arrived accurately on the end of the runway in use, was not quite so plainly audible in the public enclosure.

An impressive event was a stream take-off by 41 aircraft from six different squadrons. No. 814's Avengers started the ball rolling and were followed by No. 810's Sea Furies, No. 826's Fireflies (these with rocket assistance), No. 801's Sea Furies, and Furies and Fireflies from the R.N.V.R. Squadrons based at Stretton and Bramcote. One Fury had engine trouble and abandoned its take-off, but rapid marshalling kept the stream moving with the minimum of delay.

While these aircraft were grouping for a massed fly-past, a Hastings from Abingdon demonstrated three-engined flying, feathering one after another of its engines. The Hastings having resumed four-engined flight and taken its departure, the six squadrons reappeared ranged in good order, although they had not previously flown together.

A subtle variation in the helicopter rescue theme was introduced when an S-51 Dragonfly (Lt. W. R. Sherlock) picked up a "child" and returned it to its "parents"; C.P.O. Bigmore, the P.T.I., appropriately attired for the part, was rescued from the roof of a hangar and carried on the end of the winch cable to be deposited in the parental arms. Meanwhile the large formation had changed its order of battle and now returned to "bomb" a specially constructed tank. This was properly destroyed by a direct hit—an internecine explosion, since the crowd was too close for the use of real bombs.

A flight of three Gannets from No. 703X Sqn, still comparatively rare birds, demonstrated the great variety of "clean" and "dirty" configurations they have at their command, including a landing and wing-folding sequence. They then turned about and took off for their home base. The *pièce de résistance* was next heralded by the "box four" formation take-off of No. 898 Squadron's Sea Hawk aerobatic team, led by the Squadron's C.O., Lt-Cdr. D. G. Parker. Their performance was restricted, but not marred, by a cloud ceiling which was too low for vertical manœuvres. "In the box" was Lt. D. W. P. Kelly, and after the formation landing he turned about and took off forthwith to give the individual display for which he is justly well known.

Providing contrast to the roar of the Sea Hawks was the silent grace of sailplane aerobatics performed by Com. Plt. Cox in a Grunau from the top of a Tiger Moth aero-tow. More markedly gravity-bound was Mr. A. Harrison, who made a parachute jump from an aircraft of a kind unorthodox in such a context—the S-51. A Tiger Moth and an Auster in competition then put paid to the gravity-defying efforts of most of a series of met. balloons. Jet propulsion finally reasserted itself with a demonstration by two R.A.F. Canberras, one from Marham, the other from Binbrook, and the day was brought suitably to a close by a formation fly-past by the two resident Sea Hawk squadrons, Nos. 898 and 807, led respectively by Lt-Cdr. Parker and Lt-Cdr. P. J. Hutton.

"Flight" photograph

Airlifting of "infants" by helicopters was a feature of both the Naval Air Days. Suspended from this Dragonfly, at Lossiemouth, is a well-built child wearing woollen rompers and about two years' growth of beard.

... and at Lossiemouth

SATURDAY was also Air Day at Lossiemouth (H.M.S. *Fulmar*), in North-West Scotland, the base of two Sea Hawk squadrons and the centre of Naval fighter training. "Lossie" lived up to its reputation for good flying weather and the two-hour air display was watched by a large crowd. Highlights included a formation loop by seven Sea Hawks of 804 Squadron, and aerobatics on two, one and no engines by Sea Hornets withdrawn from storage especially for this occasion. We hope to publish an illustrated report next week.

Squadrons of Sea Hawks, now fully operational, are based at Lossiemouth and Brawdy. Those shown belong to No. 804, commanded by Cdr. E. M. Brown and stationed at "Lossie."

"Flight" photograph

AMERICAN JET-TRANSPORT PLANNING

Ways and Means Discussed at S.A.E. Meeting

SOME impression of the problems being dealt with in relation to the introduction of jet airliners in the U.S.A. can be gained from a recent aeronautical meeting in New York of the Society of Automotive Engineers. The papers read deal principally with the questions of engine noise, air conditioning and pressurization, reverse thrust and engine-intake guards.

Of noise, Mr. Arthur A. Regier of N.A.C.A.'s Langley laboratory said: "When one works for a time in close proximity to a noisy jet, one becomes obsessed with the idea of stopping the noise by putting things into the jet. Persons have probably stuck everything but the proverbial kitchen sink into the jet at one time or another in an effort to stop the noise. . . ."

The whole question of noise, it appears, is being energetically tackled by a number of agencies. The N.A.T.C.C., for example, were able to report at the meeting that they had approached the problem in two ways. First, they had attempted, "within the limits of safety and of technological ability, to reduce to an achievable minimum low, noisy flight over peoples' homes"; secondly, they had taken care to keep affected residents informed of the circumstances and the remedies being applied.

Another approach to the noise problem is, of course, through basic engine design and here a spokesman of the propeller division of Curtiss Wright Corporation claimed at the meeting that airscrew noise in turboprops could be reduced by use of slow-revving many-bladed airscrews. It was expected, however, that even without the use of "quiet" airscrews noise on very-high-speed turboprop transports would be considerably reduced.

As to jet noise, United Aircraft Corporation divided the definition of such noise into four quantities: (a) total acoustical output—power level; (b) distribution of sound energy according to frequency—power spectrum; (c) distribution of energy in space—directivity; and (d) distribution of energy with time—duration of noise.

While Boeings claimed that the main object was not "to build a bigger and better noise trap, but to use the least expensive structure that will do a satisfactory job," General Electric stated that when the usual 20 to 60 decibels sound reduction was required for today's engine test-beds the cost might work out anywhere between $500 and $2,000 per decibel attenuation.

On the subject of air conditioning—taken to include pressurization—the general opinion was that the problem for the jet airliner was in almost all respects similar to that encountered in modern high-speed piston-engined transports; "the end product" of systems for the two types was basically the same but there was a safety requirement for absolute reliability and a commercial requirement for efficiency and simplicity. Pressurization failure at 45,000ft was obviously far more critical than at, for example, 20,000ft. Even if they were breathing oxygen at the moment of failure, a crew could expect but a few minutes of consciousness; passengers not so equipped would lapse into unconsciousness in much less that one minute. To attain the required safety well-tried systems were advocated, though there was some division of opinion on the desirability of system duplication.

Considerable work has been done to evaluate various types of intake guards for turbojets. Their primary object, according to General Electric Co., was to protect the engine from "catastrophic failure" caused by the entry of foreign bodies. But U.S.A.F. research showed that only in some cases did any benefits accrue from the use of guards, while in others the failure of a light guard caused more damage than the foreign body itself. Guards were subject to icing, but they might be made to retract as soon as the aircraft was clear of the ground. Although several American companies are engaged on guard design and research no definite conclusions appear to have been reached and no official edicts have been issued on the subject.

Reverse thrust for turbojets was widely discussed and the advantages of its use were generally agreed upon. There were obvious benefits in landing performance especially on wet runways. Subsidiary advantages were quoted, such as the independence of the reverser system from the engine itself (unlike the piston engine and its reversible airscrew), the enormous power which was available for thrust reversal, and the comparative ease with which the reverser could be installed in the jet-pipe. Boeing engineers quoted 45 per cent reverse thrust as a relatively easily attainable value. Among the deflector shapes being investigated were the half-spherical W, the longitudinal-V gutter, the conical-V umbreila, the half-spherical U and the clamshell. Of these the clamshell was most favoured [*Flight*, April 30th last].

From the operational point of view many calculations of the requirements and characteristics of jet transports were reported. Airlines, particularly, had been investigating operational characteristics and formulating various requirements of desiderata. One question which inevitably concerned the airlines is that of fuel reserves for stacking and diversion. Most ambitious of the schemes so far undertaken was United Airlines' simulated jet transport operation—"paper operation." (Other airlines are now following suit.) Hypothetical "paper" flights were "operated" each day, taking into account meteorological and other conditions prevailing. Complete flight-plans were made out and airline staffs followed them through and analysed the results.

Among these results emerged the opinion that jet transports would not require special priorities to avoid stacking since their calculated fuel reserves have been assessed as adequate for conventional operations. United Airlines stated that jet transports "will be able to take their place in traffic patterns without preference, and will be able to fly to the same alternates as used by other aircraft."

To sum up, the views expressed at the S.A.E. meeting suggested that no startling problems are expected to arise from the eventual introduction of jet transports in America. Runway requirements, internal systems and operating conditions will be no more difficult or elaborate than those at present needed for aircraft of the Super Constellation and DC-7 type. To achieve the expected straightforwardness of operation, however, it is clear that constructors and operators will have to apply careful and realistic thought to the whole question of design and operation; and such an approach, of course, is familiar in present-day American air-transport procedure.

A BRISTOL APPOINTMENT

THE Bristol Aeroplane Co. announces that Mr. Peter King, press officer of the Society of British Aircraft Constructors since 1949, has joined the company as public relations officer; he took up his duties at Filton on July 5th. In his new appointment, he will be directly responsible to Mr. C. B. Bailey-Watson, public relations manager. The press officer of the Bristol Aeroplane Co. is Mr. F. H. Kelly, who is assisted by Mr. S. J. Edwards.

Mr. Peter King.

Mr. King, who is 29 years of age, was an exhibitioner of Jesus College, Cambridge, and served in the Royal Air Force from 1943 to 1949. He is succeeded in his post at the London headquarters of the Society of British Aircraft Constructors by Mr. R. T. Rockingham Gill.

C.A.I. SECRETARY NAMED

THE president of the Canadian Aeronautical Institute, Dr. J. J. Green, announced last Friday the appointment of H. Charles Luttman as secretary of the newly formed organization. He assumed his duties at the Institute's head office in Ottawa on the following day.

A native of Banbury, England, Mr. Luttman has served A. V. Roe (Canada), Ltd., in Toronto for the past seven years in an executive capacity and was appointed to the position of contracts administrator of the company's aircraft division in 1952. A graduate of Cambridge University, he became a B.A. in Mechanical Science in 1930 and an M.A. in 1946. Before going to Canada in 1947, he was connected with the aviation industry both in England and in the U.S.A. He held the position of Assistant Chief Inspector, Aircraft, for the British Air Commission, in which capacity he was responsible for the inspection of American aircraft and equipment for the R.A.F. and Royal Navy. He was chairman of the Toronto section of the Institute of the Aeronautical Sciences in 1941 and was a member of the interim council which was responsible for the formation of the C.A.I.

As earlier reported in *Flight*, the C.A.I. was formed last spring, and held inaugural meetings in Ottawa and Toronto.

HERE AND THERE

DUNKER/KILLER: The Bell HSL-1 anti-submarine helicopter—shown hovering motionless in the act of "dunking" its sonar detection equipment during tests near Fort Worth, Texas—is now in volume production for the U.S. Navy, and has already been supplied to our own Royal Navy. It has also been revealed that "lightweight homing weapons" are carried to destroy submarines pinpointed by its sonar gear. Note the effect of the rotor downwash on the water.

Transatlantic on One Engine

MRS. MARION HART landed her Beech Bonanza at Teterboro, N.J., on Sunday, July 11th, after an uneventful Atlantic crossing from Prestwick *via* the northern route in 24 hr 18 min. The equipment of the aircraft is described on Page 76.

Seeing a Source

LORD ISMAY, secretary-general and vice-chairman of the NATO Council, toured the Hunter production lines of Hawkers' Kingston-on-Thames factories on July 6th.

Birds of a Feather

UNDER the slogan "The world's best airliners are built in America," current advertising by Consolidated Vultee illustrates Convair, Boeing, Douglas, Lockheed and Martin aircraft. Emmett McCabe, Convair director, lists what he terms "false claims and overstatements" by British constructors among the reasons for the new campaign.

Advising in Denmark

AIR MARSHAL Sir Hugh Saunders, who was recently appointed adviser to the Danish Air Force, arrived at Kastrup Airport on July 7th, and was met by Herr Lindgren, Under-Secretary to the Defence Ministry, and General Foerslev. The Air Marshal said he would study his new task thoroughly before making any statement on what he thought should be done to strengthen the Danish Air Force.

Japanese Air Defence Force

A CEREMONY to mark the beginning of the training of Japanese pilots for Japan's new Air Defence Force was held on July 6th at the U.S.A.F.'s Yamoto base. It was attended by Chief of the Air Staff Kentaro Uemura and General Earle E. Partridge, Commander of the U.S. Far East Air Forces. Japan is to receive 143 aircraft from the U.S.A. this year, including a number of Beech C-45 transports, ten Lockheed T-33 jet trainers, and five North American Sabre F-86E jet fighters.

Bringing It Off

A CANADIAN pilot of a Harvard who hit a 20ft-high river-bank in Norfolk last week succeeded in landing safely at his base at Feltwell, ten miles distant, with 4ft of one wing-tip torn away.

Finland's New Trainers

THE initial batch of thirty Vihuri advanced trainers—the first aircraft to be built in quantity in Finland since the war—has been delivered to the Finnish Air Force. A picture of the Vihuri, which is powered with a Bristol Mercury VIII engine and has a maximum speed of over 270 m.p.h., appeared in our special Military Aircraft issue of June 25th.

Chance Vought Go Solo

CHARLES J. McCARTHY, vice-president of United Aircraft Corporation, has been elected chairman of Chance-Vought Aircraft, Inc. On July 1st the company was formally declared completely independent of United Aircraft Corporation.

A SWIFT IN MINIATURE was recently given to the Chief of the Royal Hellenic Air Force Staff, Air Marshal Kelaidis. A. Cdre. F. R. Drew, C.B.E., British Air Attaché in Athens, made the presentation.

W.S.55 FOR FRANCE: The helicopter seen below was recently handed over by Westland Aircraft, Ltd., to the French Admiralty.

Keeping It Up

LT-CDR. JAMES B. VERDIN, who broke the world's air speed record at 753.4 m.p.h. in the F4D Skyray last year, has joined Douglas Aircraft as a test pilot. Maj. Val Prahl has also joined the company in a similar capacity.

Northern Model Contest

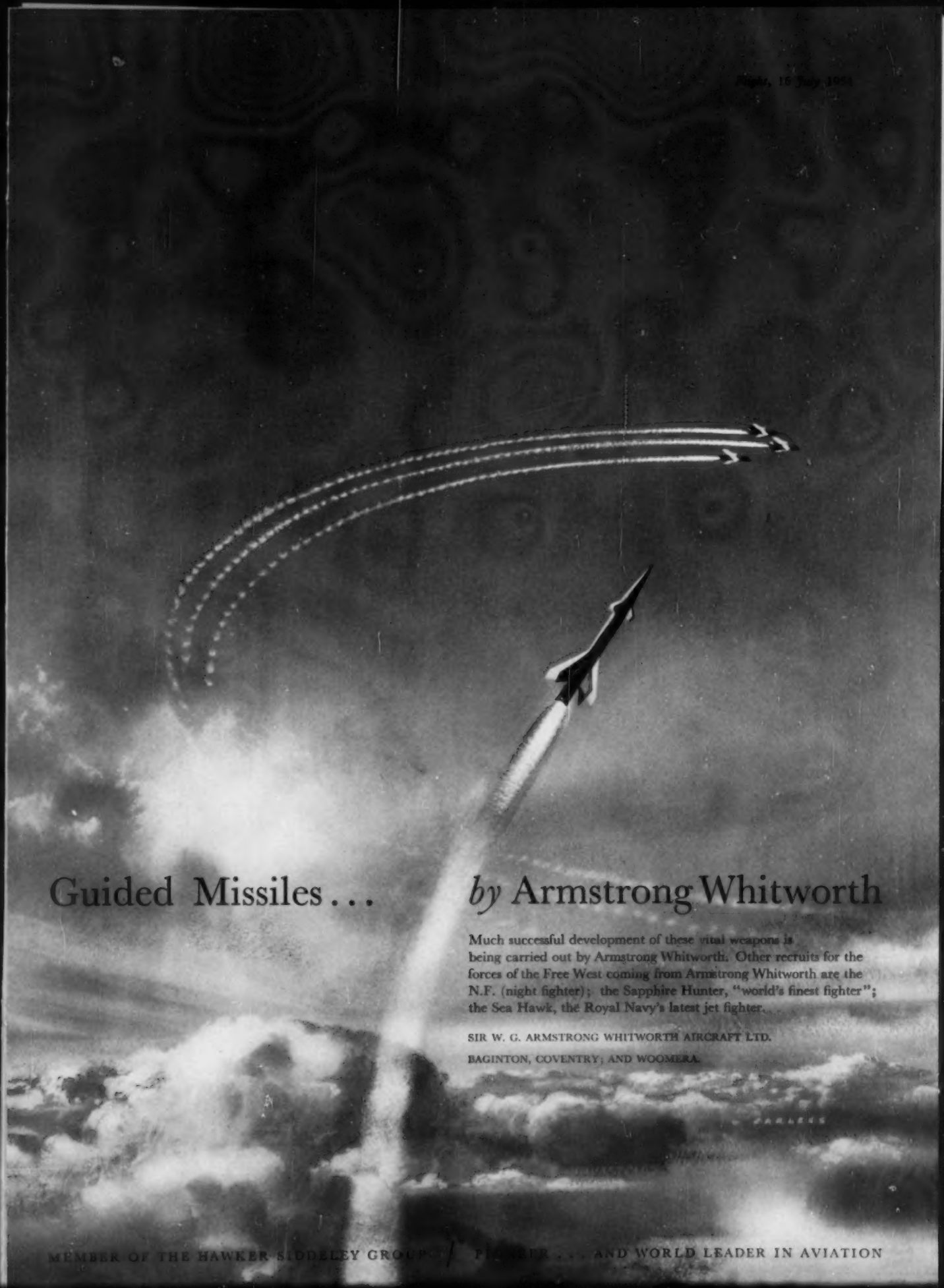
NEARLY 1,000 contestants will take part in the Northern Model Flying Gala, to be held on August 1st and 2nd at Royal Air Force Station Neasham, near Darlington. The first national model flying meeting in the North of England for several years, it is being held under the control of the Society of Model Aeronautical Engineers.

Harmon Award Winners

NAMED as recipients of the 1954 Harmon Trophy are Maj. Charles Younger (in recognition of his "achievements in the field of supersonic flight" in piloting the Bell X-1A at 1,600 m.p.h.) and Miss Jacqueline Cochrane, honoured as the first woman to fly at supersonic speed, and for her closed-circuit record of 652 m.p.h. in an F-86. The award was founded in 1926 by Col. Harmon, a pioneer American balloonist and aeroplane pilot.

Building a D.H.2

FROM Mr. S. N. Green, aero-instructor at the Provincial Institute of Technology and Art, Calgary, Alberta, we hear that, following the successful building and flying of a replica of a Blériot XI, he now contemplates constructing a similar reproduction of the D.H.2. He has managed to obtain a 110 h.p. Le Rhône engine, which he believes can take the place of the original 100 h.p Gnôme Monosoupape.



Guided Missiles . . . *by* Armstrong Whitworth

Much successful development of these vital weapons is being carried out by Armstrong Whitworth. Other recruits for the forces of the Free West coming from Armstrong Whitworth are the N.F. (night fighter); the Sapphire Hunter, "world's finest fighter"; the Sea Hawk, the Royal Navy's latest jet fighter.

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MEMBER OF THE HAWKER SIDDELEY GROUP . . . AND WORLD LEADER IN AVIATION

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GREAT HUCKLOW PROSPECTS

Advance Thoughts on the World Gliding Championships

By ALAN YATES

INTERNATIONAL sporting competition in aviation has been dwindling for years—except in gliding. In contrast to the brief races across the world by powered aircraft, the motorless variety will be flying in England for the next two weeks in a contest in which pilots from nineteen nations will fly forty-five sailplanes.

The World Gliding Championships were resumed after the war in Switzerland (1948) and in Sweden (1950). The British entrants did not distinguish themselves in these events but at the last contest in Spain (1952) the British team excelled. Philip Wills became World Champion and the new Sky sailplane won honours for its pilots, Dutch and Argentine as well as British. Perhaps as a tribute to these successes the F.A.I. chose England as the venue in 1954. The Championships begin on July 20th at Camphill, Great Hucklow, Derbyshire, the home of the Derbyshire and Lancashire Gliding Club. At this site, sailplanes can soar over Bradwell Edge in a westerly wind and over Eyam Edge in a southerly wind, and can thence fly some seventy miles in any direction before reaching the sea.

Our own National Championships have been held there since 1949, so the British entrants know the site and its weather—and, perhaps even more important, the stalwarts of the club are expert in the organization of such contests. Nevertheless, some novel problems are offered by this contest. The entry list in the Nationals has been limited to 35 whereas, for this World contest, 45 entries have been accepted (there were 59 in Spain). The limit is on space over the site and in rate of launching; it has therefore been decided that the competitions for the 35 single-seaters and for the 10 two-seaters shall be separated. The two classes may fly at different times of the day—or even on separate days.

Given reasonable weather every glider should be able to score marks on more than four days, but only the highest four marks will count in the score of each entrant: this new rule should reduce the element of luck inevitable in gliding contests. The marking will be adjusted each day so that the most successful pilot receives 1,000 points: this process is now standard and ensures that a good flight in superb weather conditions shall not be rated the same as a good one in poor conditions.

The days when a competitor could earn marks for duration or for height are over. The task set by the organizers each day will be one of three:—

(1) A free distance flight, the nearest approach to *laissez-faire*, in which the pilot earns one mark per mile.

(2) A pilot-declared goal flight, in which the mark depends on the distance to the goal and the distance covered towards it. A successful flight receives a bonus but an over-ambitious declaration is duly penalized.

(3) A race. Here the organizers choose the course, almost certainly a closed circuit, and the marks are earned for speed, with consolation marks for distance to pilots failing to complete the course.

Unless the weather deals a cruel blow an exciting fortnight is ahead. The weather conditions and the topography are novel to most pilots. The Americans, Spanish, Argentinians and others from strong thermal countries—with cloudbase at oxygen height—may find the low clouds in England a handicap. The Dutch and Danes, although used to our temperate weather, are not used to our hilly terrain. The launching by winch into, we hope, hill lift, will be a change from the aero-towing of the last two World Championships. The prospect from the top of Bradwell Edge of thousands of tiny fields bounded by stone walls is certain to amaze those used to wide open spaces. Once away from the Peak District, however, English fields are delightful for landings, but what about navigation in the land of railway lines? Has anybody told our visitors that there are lots of mineral tracks which look like railways from the air but which do not appear on the map?

Navigation for the ground retrieving crews will provide more trouble than in Spain, where nearly all flights went along one main road. The hazards, too, are different; instead of unlighted steam-rollers parked in the middle of the road we provide hurdles euphemistically called "level crossings." The roads from Camphill are narrow and steep but, with Police help, the trailer drivers should be able to avoid the expected crowds and set off on their retrieves. Those with radio communication to their glider and reliable towing cars will be helped, and the British team are lucky to have the Pye radios and Standard Vanguards which gave them such a clear advantage in Spain. Half the joy of the contest will be in the exchange of reminiscence of flight and of retrieve, so the lodging of all crews in a fleet of caravans parked close beside the precious gliders is an improvement over the Spanish hotel arrangements.

Pilots do not change as rapidly as gliders, so that many familiar names occur in the list of pilots. The British Team has the World Champion Philip Wills and the National Champion Geoffrey Stephenson flying its two single-seaters, while Mr. and Mrs. Lorne Welch will fly the T.42 two-seater (Mrs. Welch, as Ann Douglas, captained the three previous British entries). It is not revealed who is to be the back-seat driver. The non-flying captain of the British team is Hugo Trotter, of the Surrey Gliding Club.

Among the visitors will be Gerard Pierre, the young Frenchman who finished second to Wills in Spain and has gained almost every other available honour in gliding. Paul MacCready, who finished second in Sweden, knows something of English soaring conditions. Hanna Reitsch and her two-seater co-pilot, Erika Leutloff, complete the trio of women pilots; Hanna Reitsch flew in England before the war and finished second in the two-seater

Geoffrey Stephenson, British National champion (Olympia IV).

World champion Philip Wills, to fly his Sky instead of the K.1.

Lorne Welch, of the Surrey Gliding Club (Slingsby T.42).

Ann Welch, co-pilot to her husband in the two-seater class.

GREAT HUCKLOW PROSPECTS . . .

class in Spain in 1952 at a time when German gliding had just restarted.

The large number of new sailplanes reflects the absorption of new aeronautical knowledge in the postwar designs. The ten two-seaters are all different and all of recent design. The Slingsby Sky is the most popular single-seater, although almost every visiting team is bringing at least one of its home products. Although the new K.1 will not be ready in time for the contests (Philip Wills has reverted to his Sky), two of the British machines are new types—the T.42 tandem two-seater and the "laminar-flow" Olympia IV to be flown by Stephenson. Those interested in design will have an unrivalled opportunity of examining current thoughts about sailplane construction although no real assessment of the value of devices such as laminar flow wing sections, lateral control by wing warping, wingtip "tanks," wings with no ribs and many ribs and tail brake parachutes can be made from the brief period of Championship flying.

The financing of a World Gliding Championship is a serious problem. In Spain the government footed much of the bill by offering sailplanes and retrieving vehicles for the use of visitors, with free petrol and some free food. In Britain, where there is no Government gliding subsidy, a few private owners are lending sailplanes and the Standard company is lending cars, but most of the expenses will be borne by entrants; and those which will fall on the British Gliding Association are expected to reach £6,500. So far over £4,000 of this has been subscribed. much of it from the firms in the powered-aircraft industry. Many of the leaders of the industry must think wistfully of the days when international sporting flying competitions were common for powered aircraft, but a visit to Camphill in the next two weeks will convince them that the love of contest flying on an international scale is not yet dead.

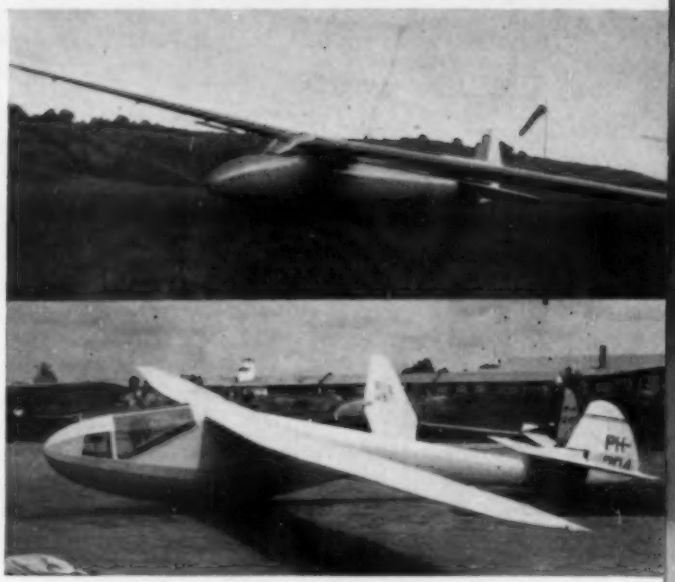
During the flying at Camphill the Fifth Congress of the Organization Scientifique et Technique Internationale du Vol à Voile (OSTIV) will be taking place ten miles away in Buxton (July 22nd-August 4th). At its sessions, papers will be read and discussed on all aspects of gliding science including meteorology, aerodynamics, structures, instruments and training methods. At a joint session with the Championship pilots and crews, reports will be given on the papers read at the Congress.

Reports and pictures of the World Gliding Championships, and an account of the OSTIV conference, will appear in subsequent issues of *Flight*.

THE ENTRY-LIST

Two-seater Entries.—*Argentine*, J. C. Ompré and C. J. Dori (Condor IV); *Austria*, W. Hesse and A. Hasenknopf (Musger Mg.19); *France*, M. Gasnier and L. Trubert (CM.71); *Germany*, Hanna Reitsch and Erika Leutloff (HKS 1); *Great Britain*, Lorne Welch and Ann Welch (Slingsby T.42); *Italy*, A. Mantelli and L. Braghini (Canguro); *Jugoslavia*, B. Komac and Z. Rajn (Ilic-Kisovec Kosava); *Spain*, L. V. Juez and R. B. de Castro (Kranich III); *Switzerland*, H. Nietlispach and B. Muller (Spyr VA); *U.S.A.*, S. W. Smith and R. Kidder (Schweizer 2-25).

Single-seater Entries.—*Argentine*, J. Cuadrado (Sky), J. S. Ortner (Sky); *Australia*, S. V. Owen (Olympia); *Austria*, F. Linher (Superspatz), W. Grafe (Weihe); *Belgium*, M. Cartigny (Sohaj), W. Witter (Sohai); *Canada*, A. Pow (Olympia); *Denmark*, H. W. Jensen (Spatz-L), A. Feddersen (Olympia); *Finland*, A. V. J. Koskinen (PIK.13), S. Relander (Weihe); *France*, G. Pierre (Breguet 901), G. Rousselet (Breguet 901); *Germany*, A. Wiethüchter (F. W. Weihe 50), E. G. Haase (HKS 1); *Great Britain*, Philip Wills (Sky), Geoffrey Stephenson (Olympia IV); *Holland*, I. de Boer (Sky), O. P. Koch (KNVvL 491); *Israel*, M. Bar (Olympia); *Italy*, R. Brigliadori (Canguro), G. Ferrari (Canguro); *Jugoslavia*, F. Mordej (Orao), M. Arbajter (Lasta); *South Africa*, H. R. Lasch (Air 100), P. J. Beatty (Skylark I); *Spain*, F. Llorente (Sky), M. Torrell (Sky); *Sweden*, P. A. Persson (Weihe), T. Loef (Weihe), *Switzerland*, A. Gehriger (WLM II), A. Kuhn (Sky); *U.S.A.*, P. A. Schweizer (Schweizer 1-23D), P. B. MacCready (Schweizer 1-23E).



Two single-seat entries (top) the Slingsby Sky, successful in the 1952 World Championships in Spain. (Bottom) The Dutch KNVvL 491.

From France and Jugoslavia: (top) the Breguet 901, which Pierre and Rousselet will fly in the single-seater class. (Bottom) The Kosava, the Jugoslav two-seater entry.

AIR LEAGUE ANNUAL REPORT

THE Annual Report of the Air League of the British Empire for 1953-54 was published on June 28th. It begins by welcoming H.R.H. The Duke of Edinburgh as patron of the League, and Lord Templewood as President.

Reviewing the problems which arose during the year, the League feels that, above all, the lack of a strategic air-transport reserve is dangerous since the strategic Army Reserve to be formed in this country will almost inevitably require it. Similar stress is laid on the necessity for proper inducements to permanent service for the right type of young man required for aircrew duties in modern aircraft. Financial assistance for the education of the children of serving officers is advocated where the situation lays extraordinary financial burdens on the families. Financial assistance is also required to assist aircrew in covering the heavily increased premiums which are demanded for life insurance policies. Finally, the League advocates financial assistance for the gliding movement, which more than anything else fosters air-mindedness in the nation's youth.

Turning to civil aviation, the League again regrets the effect of the closing of the Reserve Flying Schools on the recruitment and training of pilots for the civil air lines. Efforts in this direction have resulted finally in the Air League being asked to join (and to provide a chairman for) a committee to study the recruitment and training situation.

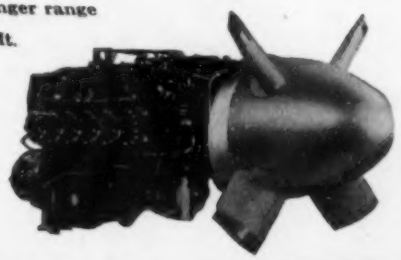
The League also attempted to secure the use of common H.F. and V.H.F. radio frequencies for air-sea communications in rescue operations. A G.P.O. proposal to introduce a frequency-modulation system for merchant vessels (which would render impossible air-sea radio communications) was particularly dangerous to rescue operations, and the League was able to stimulate official action on the subject.

As an independent body, the League was asked to investigate the formation of a Chamber of Air Transport, but this was found to be inopportune and negotiations were deferred. In conjunction with certain operators, a study of customs clearance procedures for air cargo was begun during the year and is still progressing.

In conclusion, it is stated that the League views with satisfaction the effect of its activity on the awareness of aeronautical problems in Government circles. It suggests, however, that "it must remain a matter of regret that the development of air-mindedness in the seat of Government should still be so backward, and particularly in the realization of the part which aviation ought to play in the development of the colonial empire."

LONGER RANGE-on less fuel

The Nomad is a 12 cylinder 2-stroke diesel engine compounded with a turbine compressor set — the only compound diesel designed as such from scratch. It will work efficiently on kerosene, diesel oil, or wide-cut gasoline, and its fuel consumption under any operating conditions is extremely low. At every stage of design and manufacture fuel economy was the first objective. The result is longer range on less fuel for reconnaissance and freight aircraft.



NAPIER Nomad

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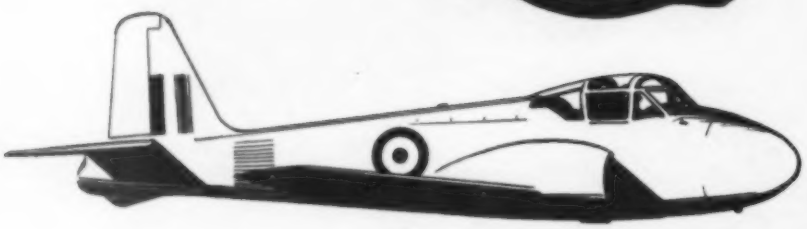
CRC N4

Ordered for the ROYAL AIR FORCE



The Sperry Mk.1E Artificial Horizon has been ordered in quantity for installation in training aircraft of the Royal Air Force. The civil counterpart of this topple-free horizon is known as the H.L.8.

THE SPERRY Mk.1E HORIZON

SPERRY GYROSCOPE COMPANY LIMITED · GREAT WEST ROAD · BRENTFORD · MIDDLESEX

PROOF of the ARIES

Impressive Performance on an England-Australia Flight

The first prototype Miles Aries, powered by Cirrus Major IIIs.

"SUPER GEMINI" was the catchline for our caption to the photograph of the Miles Aries which appeared in *Flight* on April 24th last year. The Aries had then just received its C. of A. Many readers may know that this first prototype, G-AMDJ, has recently completed a flight from England to Australia: from the owner and pilot, Mr. Anthony Vigano of Melbourne, we have received a most enthusiastic letter concerning the performance of the Aries on this flight.

The journey, which began on May 8th and finished at Melbourne on June 6th, included a two-week stay in France and Italy, the remainder of the flight being made in a leisurely manner. "The Aries performed wonderfully," Mr. Vigano reports, "and is the only private aircraft I have ever flown that comes up fully to the makers' specifications. In fact, I found that these specifications had been on the conservative side."

The letter continues; "Point to point at 2,200 r.p.m., a true air speed of 150 to 155 m.p.h. is quite easily achieved at a height of 4,000 to 6,000ft. The climb at full load is about 1,300 ft/min, while we were amazed that at 17,000ft over the Alps, for a short period, the climb was still in the region of 200 ft/min. The aircraft easily maintains altitude on one engine at 5,000ft at full weight with a temperature of 25 deg C. This was often tried over India on either engine and where temperatures are high. On suitable strips we also tried single-engine take-offs at full load and found that, holding the machine down (using both engines) until 65 to 70 m.p.h. had been reached, in order to get rudder control, either motor could be cut, the take-off continued and a climb in the region of 200 ft/min maintained, whilst at two to three thousand feet the aircraft then maintained height on cruising revs (2,200) quite easily and, due to its big rudders (larger than those of the Gemini), could easily be maintained on course.

"Petrol consumption over long hops was quite amazing and at 2,200 r.p.m., with a true air speed of 150 to 155 m.p.h., 6½ gall on each side were used—naturally with maximum use being made of the mixture controls. After we left Singapore we flew in company with a Proctor 5 flown by Mr. Beverley Snook and in order to stay with him we found we had to decrease revs to 2,000 and sometimes less, and at this r.p.m. setting we still had a T.A.S. of 125 m.p.h., and were amazed when we found we were using no more than five gall/hr on each side. I may add that our all-up weight can be left to the imagination of the reader as on a trip of this nature one always gathers weight as souvenirs accumulate, added to which neither myself nor Arthur Schutt (the co-pilot), are lightweights, both being in the 200 lb class, added to which we had an auxiliary fuel tank of 30 gall capacity on the back seat. This made a total of 96 gall plus personal luggage, dinghy, rations, water, etc. . . . The hydraulic brakes are a great improvement on those of the Gemini.

"Both the Lear ADF 12 and the Murphy MR80 23-channel V.H.F. are wonderful radio equipment, the Lear being amazingly sensitive and often homing up to 400 miles away, and the Murphy reaching up to 80 miles away at six to seven thousand feet. This is amazing when one realizes that the Murphy weighs 16 lb and the Lear, a full radio compass, weighs only 17 lb.

"After such a delightful trip, completely trouble-free and, due to proper equipment, completely without hazards, both Arthur Schutt and myself want to extend our congratulations to F. G. Miles, the makers of the aircraft, and to Blackburns, whose engines (Cirrus Major 3) purred away mile after mile without a trace of trouble and with almost unbelievable economy.

"We both feel that if there were more private aircraft of the Aries class available, then private aviation might receive the support it will eventually get, a lot sooner."

Relevant news from F. G. Miles, Ltd., is that a second prototype Aries is now under construction and should be completed by the end of the summer. Apart from its improved engine installations, this machine will not differ essentially from the first. In both these first two aircraft Gemini components have been used as the basis; the high cost of tooling for a production run has made quantity production, from scratch, impracticable. To meet the demand for Aries-type performance, however, the rebuilding of existing Geminis to Aries standard is a future possibility which is being considered at present.

FARNBOROUGH 1954

DETAILS have been announced by the S.B.A.C. of this year's Flying Display and Exhibition at Farnborough, from September 7th-12th. The arrangements follow the general lines of those for last year's show, and are as follows:—

Dates.—Monday, September 6th: technicians' and Press preview day. Tuesday, Wednesday, Thursday (7th, 8th, 9th): guest days (Trade admission by S.B.A.C. invitation only). Thursday's flying display will consist of commercial aircraft only. Friday (10th): public première. Saturday and Sunday (11th and 12th): public days (10 a.m.-7 p.m.); flying begins at 3 p.m.

Admission.—Tickets for Friday only can be obtained in advance from Autoparks Ltd., 1-31 Maclise Road, Olympia, London, W.14, or through the usual agencies. Tickets for Saturday and Sunday can be obtained *only* at the gate, on the day concerned.

Prices.—*Friday:* Adults £1, children 10s, cars £1, coaches £2, motor cycles 5s, cycles 2s 6d.

Saturday and Sunday: Adults 5s, children 2s 6d; cars £1 10s (including occupants' admission), coaches 10s, motor cycles 2s 6d, cycles 1s.

Except where otherwise stated, vehicle charges are parking fees only and do not include admission.

F-84F "AUTO HOT-SEAT"

AN automatic ejection seat has been developed by the Republic Corporation for their F-84F Thunderstreak and RF-84F Thunderflash aircraft. The seat is not automatic to the same degree as that now being introduced into the R.A.F. service; it unfastens the pilot's safety harness after ejection but does not open his parachute as well.

The seat incorporates two cartridges: the first accelerates the seat to 60 ft/sec to clear the aircraft; after a two-second delay a second cartridge acts on a piston which releases the harness, and the pilot is then able to open his own parachute. Recent tests carried out on an F-84F fuselage on the ground show that the seat reached a maximum height of 35ft and that, by the time it fell to the ground 35ft behind its firing point, the dummy pilot was already fully clear of the seat.

Republic also received a U.S.A.F. contract to develop a long-stroke ejector seat for the pilots of B-47 jet bombers. The seat which eventually resulted was equipped with extensible guide rails which, on firing, extended to twice their closed length, a single cartridge accelerating the seat to 60 ft/sec. All B-47Bs and Es now in service are fitted with this type of seat for both pilots. The observer is ejected downwards.

TRANSATLANTIC BONANZA

Comprehensive Equipment as Safeguard for Ocean Flying

Mrs. Hart in the Bonanza with her co-pilot, Brian Neeley.

NEARLY a year after crossing the Atlantic from St. John's, Newfoundland, to Shannon, Eire, in a single-engined aircraft, Mrs. Marion Rice Hart began the return journey—this time by the northern route—on the night of July 7th-8th, flying the same machine, a Beechcraft Bonanza. On last year's trip this 61-year-old sportswoman had another American, Wayne Vetterlin, as co-pilot; on the return trip she was accompanied by Brian Neeley, a British commercial pilot. Further news of the flight, if available, will be given in a late-news page in this issue; the notes which follow are by a writer who interviewed Mrs. Hart at Croydon before she proceeded to Prestwick for the take-off.

THERE is not the slightest doubt that, had she been unable to find a co-pilot, Marion Hart would have been qualified to make the trip by herself. She has a remarkable record of achievement in diverse fields, having graduated as the world's first woman chemical engineer; sailed round the world in command of a 70-footer; flown the Atlantic as a radio operator in a surplus B-17; and written books about navigation and her flights around Alaska, the United States and the Caribbean. But, quite wisely, she has decided to have someone with her to share the load of flying the Bonanza—especially if they run into dirty weather on the route she proposes to follow—of navigating, and of coping with all the wireless equipment she has had fitted to her small aircraft.

In the latter respect, N507C, as the Hart Bonanza is registered, is as well equipped as a modern airliner. A Narco Omni-range V.H.F. transmitter receiver, a Lear A.D.F. and V.H.F. T/R., a U.S. Army surplus H.F. T/R. (range), an automatic S.O.S. T/R. set and, finally, an independent battery-operated radio in case the aircraft electrical circuit should fail—these constitute the communications set-up, and are fitted to blend with the traditionally neat layout of American private aircraft.

The machine itself is a standard Beech Model 35 fitted with a Continental 185 h.p. engine, capable of cruising at around 130 kt on about 50 per cent power on the remarkably low fuel consumption of less than seven gallons an hour.

But for the type of flying Marion Hart has been doing for the past year fuel tanks holding a total of 78 U.S. gallons (65 Imp. gall) are fitted in the rear of the cabin—where the third and fourth occupants normally sit—with a 20 U.S. gall (16½ Imp. gall) auxiliary tank in the baggage compartment. With the normal tankage these additions bring the total fuel capacity to 138 U.S. gall (115 Imp. gall), or enough to last for 17 hr at cruising settings.

As in larger aircraft, the additional tanks are fitted with dumping valves to jettison fuel in the event of an emergency landing or to give the aircraft greater buoyancy if faced with a ditching.

Since the aircraft visited the British Isles last summer the tanks have remained in place except for inspections and have been carried in varying degrees of fullness, together with all Mrs. Hart's other equipment, throughout her tour of Europe, Africa and Asia.

Where survival gear is concerned N507C is a small-scale duplicate of almost any long-range transport, except that a lot of additional equipment is thrown in for good measure. Life-jackets, a life-raft, flares, exposure suits, desalting kits for drinking water, a fishing kit, food rations, and a hand-operated emergency radio all pack in on top of the auxiliary fuel tanks, where they go a long way towards keeping hand luggage and other necessities down to a minimum. Had Mrs. Hart been forced down in the sea at any time there was a very good chance that she would have survived.

Marion Hart is shy about her exploits and prefers to talk after the event than before. That is why the writer found it difficult to get her to talk about her return flight across the Atlantic and to learn what plans she was making, apart from the fact that she was taking the "round-the-houses" route *via* Iceland, Greenland and Labrador, as opposed to a direct crossing from Shannon to Newfoundland. What she would admit, however, was looking forward to seeing the rugged landscapes of Greenland and the ice-covered North Atlantic.

But while being reticent about her future achievements, she was far more informative—and amusingly so—about her 30,000-mile flight that took her through Europe, Libya, the Sudan, Ethiopia, Arabia and places east as far as Burma and Malaya.

In Egypt, she said, "We had to make a flight plan to fly from Almaza to International five miles away. It read: 'ETD 3.00. ETA International 3.05. Hours fuel on board 4.00. Time on route 5 min. Radio equipment: VHF (U/S), ADF (U/S), ILS (U/S). Survival equipment: life raft, Gibson Girl, water, signalling mirrors, food. . . .' Down it all went in triplicate. We took off. I had just time to raise the gear and put it down again and we landed at International."

But her visit to Cairo was altogether a success: she was interviewed by an Arab newspaper which produced, along with other bits of misinformation, the following:—

"A person ask her: Why you do not try to go over the Atlantic before Lindbergh, to be first?

"She said, 'True' without thinking. My plane is very little and also more smaller than his. But it is more strong and more fast. And if I was know that Lindbergh was take the chance before me, I go before him. But I am sorry, I just learn to fly shortly, about a little months ago."

The Sudanese regulations about single-engined aircraft having to fly in convoy, and the rule forbidding women to pilot aircraft except under extraordinary circumstances, had Mrs. Hart worried when she reached Wadi Halfa, the port of entry to the Sudan.

But she got by without much trouble, giving credit to International Aeradio, Ltd., who run Wadi Halfa in addition to maintaining and operating control towers throughout a large part of Africa and Asia. "It was always a pleasure to come into an I.A.L.-controlled field," she said, "because you were always sure of being able to converse in intelligible English."

One of the remarkable things about the Bonanza is that it seems to take plenty of punishment without batting a cowl flap—not that this particular machine has been subjected to any out of the ordinary bashing. But, in general, it was being taken off at 300 lb overload, even from high-altitude airfields like Asmara, which lies at 8,000ft. There "we made it off the 7,000-foot runway," said Mrs. Hart, "but our rate of climb was nothing to inspire confidence."

Later, during a flight from Addis Ababa to Dire Dawa, she hit an eagle at 5,000ft and, from her description, its wing span was only slightly less than that of the Bonanza. It crumpled the leading edge of the port wing for over two feet and the metal was torn away around the landing light, leaving a hole about three inches by six.

The odd thing is that the aircraft was not affected in the slightest and maintained speed and trim setting just as though nothing had happened. The hole was patched with a bit of fabric and dope and later properly mended at Aden.

In other respects N507C gave little trouble in the 200 hours it had flown in the last year, which speaks highly for the type, nearly 4,000 of which have been built in the United States since the war; this reliability was maintained despite the casual way in which mechanics in certain parts of Europe and the East regard oil leaks, mag drops and other technical nuisances.

Judging by Mrs. Marion Hart's past record the aircraft may well fly on to other new places after only a short stop at New York. You cannot under-estimate this remarkable woman. For her, flying—anywhere, over and between continents—is a pleasant and convenient way of getting around.

By SABENA to SOUTH BANK

S-55 Centre-to-centre Demonstration Trip Beats Airliner Time

ON Wednesday, July 7th, Sabena Belgian Airlines operated the first direct Brussels to London helicopter flight, with their chairman, M. Gilbert Perier, as the first passenger. The Sikorsky S-55 was flown by M. Anselm Vernieuwe, the company's operations manager, landed at the Waterloo rotorstation and subsequently made several short flights along the river.

The S-55 took off from the heliport near the centre of Brussels at 0815 hr and touched down at Waterloo at 1103—a journey time of 2 hr 48 min. On a centre-to-centre basis, the helicopter thus beat a B.E.A. Elizabethan, whose passengers had left central Brussels by coach 35 minutes before the helicopter took off and were delivered in the same manner at Waterloo eight minutes after it had landed.

To celebrate the occasion a luncheon was held at the Dorchester Hotel, during which both M. Perier and M. Vernieuwe demonstrated, by their excellent and informative speeches—in English—that the successful operation of fixed-wing and helicopters are but two of their accomplishments.

After M. Perier had proposed the loyal toast to the Queen, and Lord Douglas of Kirtleside that to the King of the Belgians, M. Perier then said that he had been delighted by the reception accorded to the helicopter that morning. The newspapers had made mention of noise and complaints, but not of the many supporters of helicopters in London. He recalled that the S-55 had flown Bleriot's route across the Channel. Alcock and Brown had flown the Atlantic ten years after Bleriot's Channel crossing, but the order had then been reversed, and S-55s had flown the Atlantic two years before the Sabena Channel crossing. M. Perier gave credit to B.E.A. for being the real pioneers of helicopter operations; if Sabena were now ahead, he said, it was because England was an island and Belgium a small country.

Among those who were welcomed personally to the lunch were Lord Douglas of Kirtleside, Sir Alfred LeMaitre, Mr. Peter Masefield, and the Mayor of Willesden. M. Perier then handed over to M. Vernieuwe for a review of Sabena's helicopter experiences and planning.

M. Vernieuwe, who is a very experienced pilot of both helicopters and fixed-wing aircraft (and who, incidentally, has an unusually distinguished war record in undercover operations in occupied Belgium and later as an R.A.F. night-fighter pilot), gave a most informative summary, which we repeat here practically unabridged:—

"The future of this new means of transport will mainly depend on the way passengers accept it. In that respect, the study of their comments is most encouraging and shows that the helicopter is already widely accepted.

"With present single-engined helicopters, we operate only in daytime and in weather conditions down to half-mile visibility and 300-400ft ceiling. During the winter, especially in the morning, when those weather minima were not met, we had to cancel flights; this, of course, is detrimental to the good reputation of the helicopter among the public. Therefore, to fly on instruments is a "must" and we believe that, as soon as multi-engined helicopters are available, instrument flying will soon become a routine and that take-off and landing might even be achieved in zero-zero weather conditions, thus giving greater regularity to the helicopter.

"In our 10,000 flying hours we encountered no major technical setbacks and with our present fleet of Sikorsky S-55s we have a daily utilization of about 5 hr per helicopter in the winter and in the so-called summer season 7 hr, which gives us a yearly utilization of 1,750 hr per unit, which is satisfactory.

"Within a radius of a little over 200 miles of Brussels there are 72 million inhabitants (nearly half the population of the United States). They consist of 12 million Englishmen, 15 million French, 20 million Dutch and Belgians, and 25 million Germans; and in this radius are 140 towns with populations ranging from 50,000 to 7 million. The same circle drawn around New York would include only 22 million inhabitants. This radius of 215 miles has not been chosen at random but represents for the helicopter, in its present and near future configuration, the most practical and economical range. Moreover, it is over such a distance that the helicopter will enable the most time to be saved when compared with other means of transport.

OO-SHA, the Sabena S-55 used for the test, flies eastward over the City of London, keeping to the line of the Thames. In the foreground is the Monument; Gracechurch Street runs northward. The photograph was taken from the "Evening Standard's" S-51, G-ANAL.

"The fastest trains on the Continent have an average block-to-block speed of 32 statute miles an hour, and if a joint journey—railyway/boat—is to be made from the Continent to the United Kingdom or *vice versa*, the block-to-block speed declines to 31 m.p.h.

"This area is, of course, also covered by air services stopping at the five main airports—London, Paris, Brussels, Amsterdam and Frankfurt. The airlines involved are using up-to-date equipment with cruising speeds averaging 270 m.p.h. (Elizabethan and Viscount) and 240-340 m.p.h. (Convair), but the average journey speed from city centre to city centre remains in the neighbourhood of only 57 m.p.h. If, on those same ground and air networks, helicopters with a cruising speed of 150 m.p.h.—giving them a block-to-block speed of 130 m.p.h.—were to be operated, the journey would be reduced to one-half or one-quarter of its present duration respectively.

"It was by looking carefully into these various data that we realized the promising future of the helicopter for passenger transport on short distances in this area. With a view to gaining the necessary experience before carrying passengers, a mail network of 300 miles was started in Belgium in August 1950. During the last four years more than 500,000 pounds of mail have been carried with over 97 per cent regularity. More than 7,000 flying hours have been accumulated and valuable operational and technical experience gained.

"Three years later, in August 1953, with all our mail-operation experience behind us, the international passenger network was officially opened. So far, 18,000 passengers have been carried, and in 1954 alone we expect to carry about 24,000.

"Helicopter operations have to be simple and therefore we have always tried to consider helicopters more like buses than aircraft. Embarking and disembarking, passengers carry their baggage themselves and the formalities have been reduced to a minimum."

Turning to the economic aspects of Sabena's helicopter operations, M. Vernieuwe said:—"I should like to make an approach different from the usual one, which consists in trying to 'guesstimate' cost figures of the hypothetical helicopter of tomorrow, and inevitably concludes that it will be too uneconomic to operate.

"I doubt very much if, over distances of up to 300 miles, any fixed-wing operator in Europe actually makes a profit. Yet they all operate short-haul flights with revenue per mile often half their cost. The reason is obvious: Short-haul traffic brings passengers to medium and long-haul operations.

"So the question for the carriers operating rotary wings is no longer: 'Will the helicopter break even?' but 'Will it lose more or less money than the fixed-wing aircraft?' The answer depends more on the ability of the helicopter to go places, and collect more passengers where the fixed-wing cannot go, than on the actual cost of the one against the other.

"Of course, we airline people are most anxious to get the cost of the helicopter down as much as possible . . . and even further down! But let us be practical: over distances where the helicopter is to operate there is no means of transport, air or surface, which makes a profit. How could the helicopter, still in its early stages, do better?

"Helicopter operating cost must, of course, be decreased considerably. At the present time, unfortunately, definite factors of the direct operating costs are against it. The cruising speed of the helicopter is still low and its payload small when compared with fixed-wing aircraft. In other words, in its present stage the

BY SABENA TO SOUTH BANK . . .

helicopter is too small a producer of ton-miles to be economical; but the speed (which recently has increased more than twice) and the payload (which has increased fifteen times) will be increased still more.

"The life of the components will also be increased, which will bring about a further decrease in operating costs. For instance, an S-55 rotor blade costs $4,000 and has lasted only 1,200 hours. Accordingly, a set of three represents $10 per flying hour. A blade's life has recently been extended to 1,800 hours and the same extension goes for the main gearboxes, tail rotor, transmissions, etc. Experience and improved designs will therefore, as time goes by, reduce operating costs considerably."

Summing-up, M. Vernieuwe said:—"The helicopter is here to stay. The present stage of single-engined helicopters with a small payload and low cruising speed represents the last stages of the pioneering and a costly introduction to stage No. 2, which may begin early in 1957. Twin-engined helicopters carrying 30 to 35 passengers over distances greater than 200 miles will, late in 1957, open a new era in rotary-wing operations.

"Airlines, of course, cannot afford the tremendous cost involved in developing big helicopters, but commercial versions will come out of military designs. If current military planning is carried out, the third stage will be reached within the next ten years. Airlines will then have 40-50-seater helicopters with flight cost per seat not exceeding that of the present twin-engined fixed-wing airliners.

"Improved designs equipped with gas turbines will take over routes from the aeroplane and directly compete with the railway, the motor coach and the private car over stretches of up to 300 miles. The cruising speed of these compound helicopters will then be in the nature of 250 m.p.h., bringing the travelling time from city centre to city centre down to 70 minutes between Brussels and London, and 75 minutes between Paris and London. Accordingly, we may conclude that the helicopter will fill three main tasks:—

(1) It will replace fixed-wing aircraft over short inter-city routes, where it will be faster. (2) It will feed passengers to fixed-wing aircraft, bringing them to major airports from cities either without airports or, if they have an airport, not linked to the international fixed-wing network. (3) It will reach the final stage, when it will compete directly with the existing means of ground transport and gain for aviation the important market of short-distance transport, by linking cities which today have to rely on surface transport only."

APPLICATIONS OF ELECTRONICS

Industrial Applications Reviewed at Oxford Convention

MORE than 300 delegates, from many parts of the world and representing nine industries, met last week to discuss industrial electronics at the convention held at Oxford by the British Institution of Radio Engineers. Among the industries represented were those concerned with aircraft, motor, rubber, iron and steel, oil, glass and instrument manufacture, together with the film industry and electricity supply. Countries sending representatives included the United States, Canada, France, Holland, Australia, India, Pakistan and Eire.

Thirty-eight papers were discussed, all of them dealing with very varied applications; among subjects considered in relation to electronics were computers for office and factory use, ultrasonics, industrial X-rays, nucleonics, gauge transducers, engine testing and machinery control. Incidentally, it is estimated that electronic equipment could take over the work of nearly 250,000 book-keeping and pay clerks in British factories during the next five years.

Below we give brief digests of some of the convention papers dealing with subjects concerning the aircraft industry in varying degree.

Electronic Computers and Industrial Mathematics (B. D. Dagnall and R. L. Michaelson).—In this paper, the basic theory and mode of operation of a high-speed digital computer was described in functional terms, without reference to details of electronic circuitry. A complete "programme of instructions" to cause a typical computer to carry out a simple job was given, and the programming of two representative engineering calculations was briefly discussed. The factors which an industrial organization must take into account before purchasing a computer were considered.

Some Comparisons between Analogue and Digital Computers (W. E. Scott and A. C. D. Haley).—This paper discussed the reasons for using computers in industry and the considerations which should apply to the choice of machine for different types of work. Examples were given of both analogue and digital machines and the uses to which they can be put. The advantages and disadvantages of each type were mentioned, with the aim of encouraging a rational approach to design.

Electronic Computers in Aircrew Training Apparatus (A. E. Cutler).—After discussing the economic advantages of training on simulated equipments, the author described some of the problems solved by the computers in flying trainers, engine trainers and track recording. The relative complications of a full flight-simulator computer using digital and analogue methods were considered, and the analogue type found to be most suitable. Details of utilization, running time and percentage serviceability were given, and further applications of analogue methods to training equipments were discussed.

Improved Techniques in Ultrasonic Flaw-detection (G. Bradfield).—The use of barium titanate crystals with backing and with monitoring crystals to assess the ingoing signal for flaw detection was discussed; the use of laminated-wedge mode-changers and steerable beam systems of ferro-electric materials were described.

Some Typical Circuits for Industrial X-Ray Apparatus (J. J. Bliss).—The nature of X-rays and their use in non-destructive testing was briefly outlined. Suitable X-ray tubes and the associated h.t. generators were described and problems of exposure control and timing referred to. A typical 250-kV industrial X-ray generator was described, special attention being paid to control equipment.

Wire Strain-gauge Transducers for the Measurement of Pressure, Force, Displacement and Acceleration (J. L. Thompson).—The theory and construction of wire strain-gauges for the measurement of pressure, vibration, acceleration, force and torque were discussed, and consideration given to the special applications of unbonded gauges. Practical details of strain gauge technique were given, and special reference was made to methods of fixing gauges to the structures under examination.

Electronic Control of Resistance Welding (C. R. Bates).—The electronic circuits commonly used for single-phase welding control may be classified into two basic types (1) leader-follower circuits, (2) feedback-trigger circuits; details of these circuits were given. Electronic control of weld heat for spot and seam welding and a discussion of control circuits followed, including "slope control" for welding aluminium and its alloys. In this, the rate of change, or slope, of weld-current is accurately governed and yet may easily be varied or adjusted. Circuits for automatic variations to compensate for changes in supply voltages or welding conditions were described.

Replacement of the Human Operator by Non-Specialized Programme Machines. (G. T. Baker).—Typical processes carried out by personnel are assembly operations and the feeding of powered machines. Electronic technique provides a means whereby the parameters defining the motion can be specified in a manner that can be rapidly programmed to meet any particular operation. Some of the flexibility of the human hand can be provided by detachable elements which the machine selects automatically during a programme. The remainder of the problem can be reduced to two elements, a joint and a power source, i.e., a muscle. Typical designs were given and the solution shown to be well within the scope of existing manufacturing technique. Convenient methods included telephone-type apparatus, punched paper tape and the magnetic drum.

WIN FOR WETHERSFIELD

FOR more than a week, 12 teams of pilots, representing eight U.S.A.F. air forces and commands, recently took part in a "gunnery and special weapons meet," on the huge Indian Springs gunnery range, near Las Vegas, Nevada. In a programme which included ground strafing, dive bombing, skip bombing and rocketry, aircraft from all parts of the world took part, and the top place was awarded to the 20th Fighter/Bomber Wing (F-84G Thunderjets) based at Wethersfield, near Braintree, Essex. Cited by the U.S.A.F. for their individual performances were Col. John A. Dunning, commanding the 20th wing, and Maj. John J. Kropenick, of the same unit, who won first place in both the high-level and dive-bombing competitions.

Specially painted for Armstrong Siddeley, Roy Nockolds' abstract design portrays the tremendous power/speed potential of the Sapphire turbojet.

Chosen to power an impressive list of aircraft for the air forces of the N.A.T.O. powers — the Sapphire develops over 8,000 lb. thrust. With its small frontal area, resulting from an annular combustion chamber, the Sapphire blends well into the aerodynamic forms of supersonic aircraft.

★ **THE SAPPHIRE** *is being manufactured under licence by the Wright Aeronautical Division of the Curtiss-Wright Corporation in the U.S.A., where it is known as the Wright J-65.*

The Hawker
HUNTER *F.2 fighter*

The Gloster
JAVELIN *all-weather fighter*

★ *The Republic F.84F*
THUNDERSTREAK *fighter*

The Handley Page
VICTOR *crescent-wing bomber*

★ *The*
MARTIN B57 *(Canberra) bomber*

★ *The North American*
FURY *fighter*

★ *The Douglas A4D*
SKYHAWK *bomber*

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THE
FORMULA FOR
SUPERSONIC FLIGHT

GYRON

AIRCRAFT INTELLIGENCE

IN BATTLEDRESS: When our description of the Auster A.O.P.9 was published ("Flight" June 11th) the first machine—there is no prototype in the accepted sense—had not been given its green/brown military uniform. Seen here during its handling trials, it shows recent modifications which include large entry steps and anti-spin strakes just below the level of the tailplane.

Great Britain

Boulton Paul P.111A. There is reason to suppose that, if this Nene-powered research delta has not already achieved supersonic flight, it will do so in the near future, and that this accomplishment will be demonstrated at the S.B.A.C. Display. On the first appearance of the aircraft it was officially announced that it would be used for "aerodynamic research at or near the speed of sound."

Canada

Avro Canada CF-100 Mk 4. American reports indicate that this big twin-Orenda all-weather fighter can carry not only eight 0.5in guns and 108 unguided rockets but guided weapons also, there being racks for a single missile under each wing-tip. Initially of Canadian design, these weapons are only temporary; and according to *Aviation Week*, "eventually, the CF-100 will bristle with six Hughes F-98 Falcon missiles at each wing-tip."

United States

Convair Hydroski Fighters. Trials with the XF2Y-1 Sea Dart continue, and Convair state that only two pairs of Westinghouse J34s were used during six months' rigorous water- and flight-testing, and that only three corrosion spots were noted. Possibly the larger J46 will be substituted later. Design development is proceeding on larger and faster water-based fighters, with a single ski and single engine, and the first—now being built—will be the "one-legged" XF2Y-2. Later designs will have a single Wright J67 or Pratt and Whitney J75 turbojet (of some 20,000 lb thrust). An Italian journal mentions an F3Y, with a speed of 1,050 m.p.h. and an initial climb of 28,000ft/min.

New U.S.A.F. Fighters. Prototypes are being built of the following: McDonnell F-101 (a very large, long-range machine powered by *two* afterburning J57s, to become operational as the F-101A and RF-101A Voodoo, and with a performance higher than that of either the F-100 or F-102); the Republic F-103 (a long, needle-nosed machine, with a small delta wing well aft, and powered by a large turbojet, the reheat tailpipe of which can be used alone as a straight-through ramjet); the Lockheed F-104 (a small, unswept-wing air-superiority fighter weighing 18,000 lb, powered by a J65 Sapphire); the Republic F-105 (similar to the RF-84F, but larger, with more sweep, powered by an Allison J71 and having a variety of functional noses, interchangeable in the field); the North American F-107 (see "F-100" below); and the F-108 and 109, which may be the Bell and Ryan jet-propelled V.T.O. machines.

North American F-100. Production F-100 Super Sabres (of the F-100A sub-type) show many differences compared with the prototypes, notably in the revised shape of the fin, the much smaller rudder, and the simpler variable-area tailpipe nozzle. Much of the structure is integrally stiffened by being milled from solid slabs, and titanium alloy (including RC-130A) is extensively used in the rear fuselage. New variants, not yet built but already earmarked for production, include the F-100B all-weather fighter, the F-100C fighter/bomber—to carry a heavy underwing load of armament and fuel—and the F-107, believed to be the production version of the F-100B.

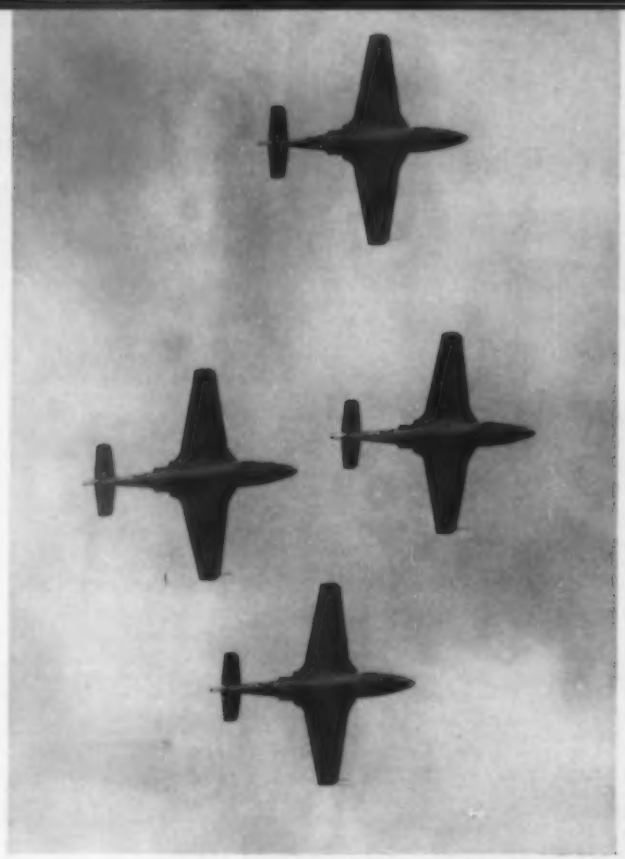
France

Morane Saulnier M.S.760. Morane Saulnier's test pilot Jean Cliquet will shortly leave India, where he has been demonstrating the M.S.755 Fleuret twin-jet trainer. In a few days' time he should begin flight trials of a Fleuret development: the fast M.S.760 liaison aircraft, with twin Marboré IIs.

S.N.C.A.S.O. Notes. In their annual report for 1953, this national group give some details of current activities. Production of the Vautour, in several forms, will reach a peak in about one year's time. Pre-production Djinn tip-drive helicopters are on the assembly line, mostly for the French army, and output of wings and other major airframe parts for other companies continues at a high rate, notably for Dassault Mystère 2s and 4s, and M.D.315s, 312s and 311s. Two prototype S.O. 9050 rocket fighters are being assembled—these being direct developments of the S.O. 9000 Trident, one of which crashed—and tests are continuing with four S.O. 6020-series Espadons, particularly with a view to perfecting the rocket motor of the S.O. 9050. From America, we hear that one Djinn has been bought by a mid-Western crop-dusting firm.

LOCKHEED P2V-7 NEPTUNE
(Two Wright R-3350 Turbo-Compound and two Westinghouse J34 turbojets)

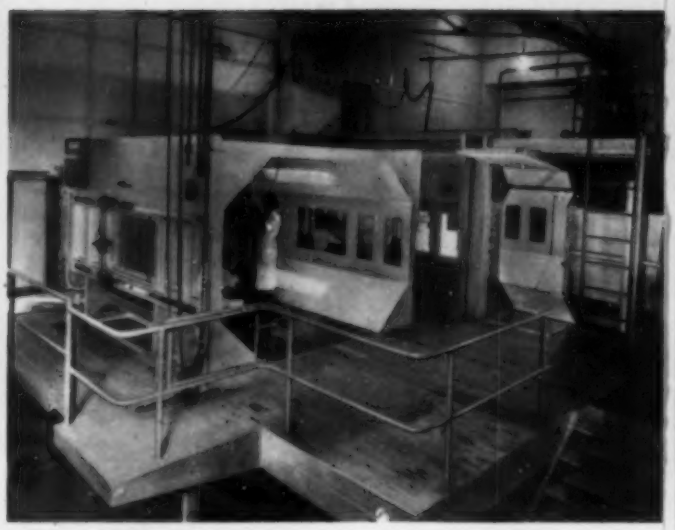
Span	104ft
Length	91ft 8in



PROPS, JETS, ROTORS, GRAVITY

NOW is the season of Naval air displays, where our photographers invariably secure some uncommon types in their haul. The present selection, for instance, ranges from the burly Double Mamba turboprop-powered Fairey Gannet A.S.1 (right) to the Grunau Baby sailplane, seen in the right-hand column below it. The graceful jet fighters on the left are Nene-powered Hawker Sea Hawk F.1s, and beneath them, with their Python turboprops being opened up for take-off, tower two Westland Wyvern S.4s. At the foot of this page, pulling out after a mock dive-bombing attack, is a Hawker Sea Fury F.B.11—last of the Navy's piston-engined fighter/bombers, fitted with a Bristol Centaurus. The helicopter at lower right is a Sikorsky S-55 Whirlwind, and beneath it—acting as gun-platform in a "dinner-plate shoot"—is one of the few remaining de Havilland Tiger Moths (Gipsy Major). Finally we have a Supermarine Attacker F.B.2 (Nene) of the Naval Air Fighting Development Unit, with strange appendages (shown in close-up last week) beneath its wings.

First-, Second- and Third-line Naval Aircraft Depicted in "Flight" Photographs



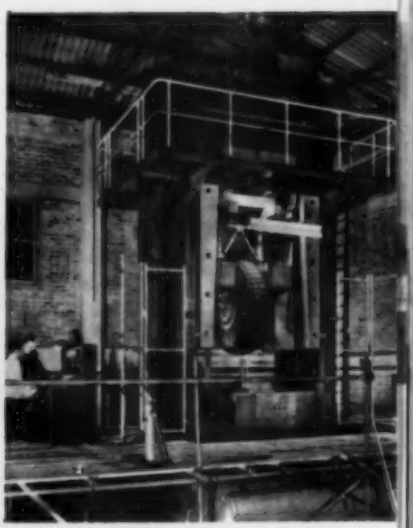
Jindivik fuselage in the low-speed wind tunnel and (right) a view of the duplex working sections for this tunnel

RESEARCH IN AUSTRALIA

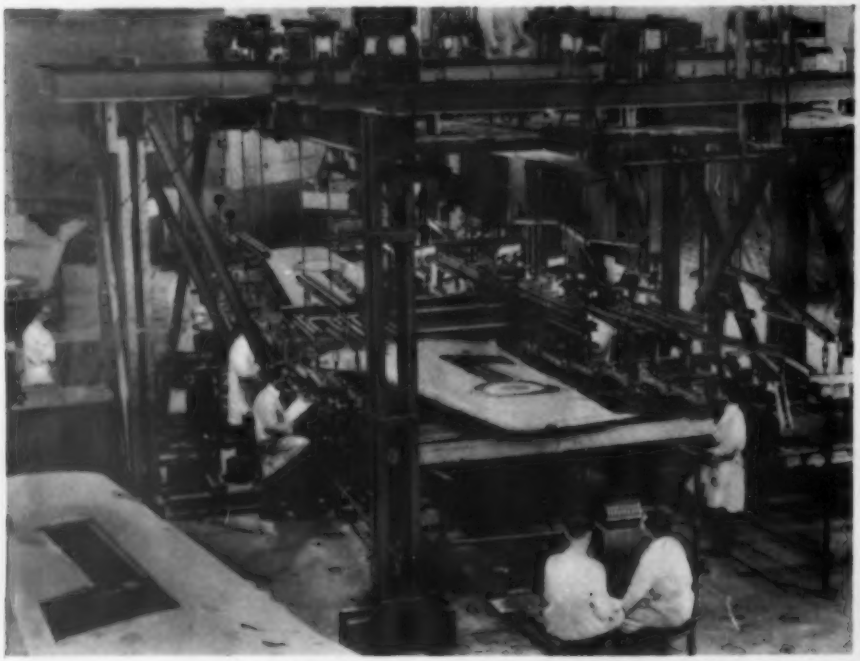
AT Fishermen's Bend, outside Melbourne, are situated the Aeronautical Research Laboratories of the Australian Department of Supply. Under the guidance of the Chief Superintendent, Mr. L. P. Coombes, both routine and highly original experimental work is being undertaken in the several separate departments.

Representative work illustrated on this page includes the fatigue testing of a Mustang wing in the structures department, headed by Dr. F. S. Shaw, and (above) the examination of a full-scale Jindivik fuselage in the low-speed 9ft by 7ft wind tunnel. The two side-by-side or duplex working sections of this tunnel—a convenient time-saving arrangement devised by the A.R.L. which has increased utilization by 60 per cent—can be positioned in turn both quickly and easily. The small illustration on the right shows a tyre and undercarriage testing rig which has now been purchased by the R.A.E. and re-erected at Farnborough.

As an indication of the wide variety of other current studies we may mention the production of a chromium that is ductile at room temperature; the development of gas-turbine combustors which burn brown coal; and research to obtain increased lift from thin swept wings by control of the boundary layer. Details of work being undertaken in connection with missiles and ramjets may not be disclosed.



An A.R.L. tyre and undercarriage test rig, now transferred to the R.A.E., Farnborough.



(Left) A hydraulic rig designed to apply large repeated loads to wings for determination of fatigue life.

We are on the side of Wright *

Our fleets of Hermes, Vikings and Dakotas are a far cry from Orville Wright's heavier-than-air nightmare—

—but for 25 years we too have pioneered aeronautically in many ways—

—carrying strange cargoes to stranger places (2 white rhinos we took to Antwerp)—

—helping to combat tse-tse fly with aerial pest destruction and so on—

and we led again with **SAFARI** *Service offering the lowest fares on Africa — U.K. routes*

* *That's right. Had a brother, Wilbur*

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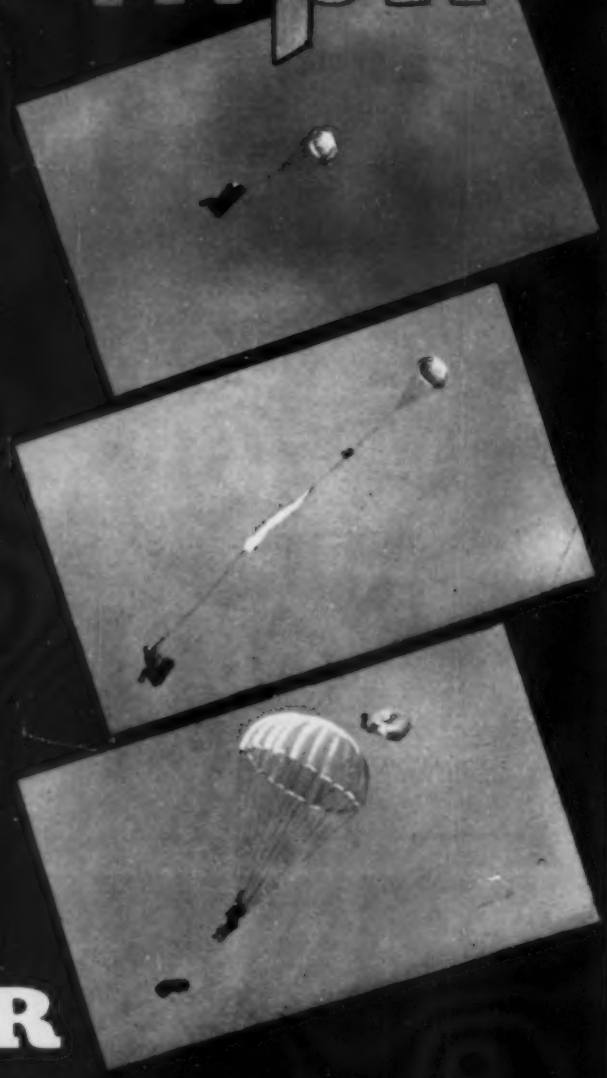
at low altitudes each second is vital

150 ft.

600 mph



On the 17th March, 1954, an ejection in straight level flight was made from a Meteor 7 aircraft with the Martin-Baker Patent fully Automatic Ejection Seat.

- The speed 600 m.p.h., the height only 150 feet.
- One second after ejection, drogue developed holding seat steady and slowing it down.
- Three seconds after ejection, parachute fully developed with 80 feet in hand.

Patented in the principal countries of the world and certain patents pending.

MARTIN–BAKER

AIRCRAFT COMPANY LIMITED HIGHER DENHAM NEAR UXBRIDGE MIDDLESEX

On this Avro 504J—serial number C4451—His Royal Highness Prince Albert (later King George VI) learned to fly. His late Majesty was, in fact, receiving a lesson in the aircraft when this photograph was taken.

THE AVRO 504

PART 2

Historic Military Aircraft No. 8

By J. M. BRUCE, M.A.

IN the autumn of 1916 a new 504 variant was built for the R.F.C. This was the 504J, powered by the 100 h.p. Gnôme Monosoupape engine, and more popularly known to the R.F.C. as the Mono-Avro. The engine was installed in the usual nose-bearing mounting, and the cowling was little different from that of the other rotary-powered Avros. The R.F.C.-pattern wings with short ailerons were fitted, and there was no tail fin. As the supply of Mono-Gnômes permitted, machines which had been ordered as 504As were built as 504Js; production aircraft began to appear in 1917 and were issued to R.F.C. training aerodromes.

At the end of 1916, Major R. R. Smith-Barry was given command of No. 1 Reserve Squadron at Gosport. He had qualified for his R.Ae.C. aviator's certificate (No. 161) on November 28th, 1911, and had gone to France with No. 5 Squadron in August 1914. After recovering from injuries sustained in the crash of a B.E.8 he had served at home as an instructor, and had flown at night on anti-Zeppelin patrol. In July 1916 he was given command of No. 60 Squadron, and returned to England in the following December.

In his duties with No. 1 Reserve Squadron, Smith-Barry evolved an instructional technique which consisted largely of demonstration and explanation. At that time so little was known about the reason's for an aeroplane's reactions to control movements that the Smith-Barry system was revolutionary in its approach, but soon proved its worth in the results it produced. No. 1 Reserve Squadron acquired an enviable reputation and was known throughout the R.F.C. as a thoroughly efficient training unit.

Major-General J. M. Salmond, who was then in command of Training Division, had given Major Smith-Barry a completely free hand. When the results proved to be so excellent, Maj-Gen. Salmond recommended that No. 1 Reserve Squadron be expanded and developed as a School of Special Flying, with the main object of training instructors in order that the Smith-Barry system might be spread throughout the R.F.C.'s training organization. This was done in August 1917 by the addition of Nos. 27 and 55 Training Squadrons.

The chosen instrument of the Gosport School was the Avro 504J, and Smith-Barry gave a salutory shock to the contemporary philosophy of flying training by giving *ab initio* instruction on it. Up to that time opinions of the Avro had been remarkably diverse: they varied from the one extreme of regarding the aircraft as a dangerous, over-sensitive machine, to the other of recognizing it as the delightful aeroplane it was. At all training stations, however, it had been regarded as an advanced type to which pupils graduated after receiving elementary instruction on such types as Maurice Farman Longhorns and Shorthorns.

In its time and in relation to contemporary front-line types, the Avro 504J was very nearly ideal as a trainer. The controls were light and powerful, and the machine's response to their use was both lively and positive. The sensitivity of the controls was a great aid to the Smith-Barry doctrine of demonstration, and at the same time revealed pupils' faults immediately. The rotary engine gave pupils a realistic foretaste of what they might expect on rotary-powered Service types; and the narrow track of the undercarriage permitted the demonstration of torque effect on take-off, for it revealed the Avro's tendency to swing. In this further respect, therefore, pupils learned what was to be expected of scouts with higher-powered rotary engines. The fact that the 100 h.p. Mono-Gnôme would continue to turn over freely when switched off enabled forced landings to be taught realistically, and the engine was controlled by a single lever only.

The rate of climb was good enough to enable a useful height to be reached in a reasonable time, and the Avro could perform all aerobatics known at that time. The Avro 504J deserves to be remembered as the aeroplane which made possible the R.A.F.'s system of flying training, a system which, at its inception, was far ahead of any other method of instruction and which, but little modified, remains in use today.

The exploits of the Gosport Avros in the hands of such pilots as Capt. Williams, Capt. Foote, Capt. Duncan Davis, and Maj. Brearley have assumed a near-legendary quality which was

Parnall-built 504K, with 100 h.p. Gnôme Monosoupape engine.

THE AVRO 504 . . .

not surpassed by any of the warlike achievements of the Avro's operational contemporaries. The "party piece" of Capt. Williams, commander of "C" Flight, was to land between two hangars more or less regardless of wind direction, turning completely round immediately after touching down and finishing his landing run inside "C" Flight's hangar. Williams' machine was the 504J numbered C.4448.

Another distinguished Avro 504J was C.4451. It was on that aircraft that H.R.H. Prince Albert, later King George VI, learned to fly.

Such was the fame of the Gosport system that in 1918 four Gosport instructors and four Mono-Avros were sent to France to advise and assist in the training of French pilots.

At Gosport, pilots were not only permitted but were expected to fly their Avros to the limits of the machine's capabilities. Not only did this instil great confidence and flying skill, but it also provided the most thorough test of the aircraft; and Gosport became an authority on Avros and what could or could not be done on them.

Some experiments were carried out there. Single-bay wings of reduced span were fitted to B.4264, and the modified machine performed very well. Standard wings were later fitted, but with the gap reduced to 5ft 1½in.

One important consequence of the success of the Gosport system was the decision to standardize the Avro 504J as the R.F.C.'s training aeroplane. The demand for the Avro swelled enormously, and contracts were placed with a large number of manufacturers.

Unfortunately, contracts for the 100 h.p. Monosoupape engine had been allowed to run down as it ceased to be used in front-line aircraft. British production of the engine was tapering off towards the end of 1917, and despite its revival in 1918 it was obvious that Mono-Gnômes would not be forthcoming in sufficient quantities to equal the output of Avros.

To overcome this difficulty, all surplus rotary engines were recalled from all aerodromes in England and France. This action produced a mixed collection of 130 h.p. Clergets, 110 h.p. Le Rhônes and even 80 h.p. Le Rhônes. The installation of the 80 h.p. Le Rhône was a fairly straightforward job, and some 504Js had that engine. The larger engines did not fit into the airframe easily, and modification was necessary. Lt. Col. Smith-Barry has been credited with the idea of making the 130 h.p. Clerget, 110 h.p. Le Rhône and 100 h.p. Gnôme Monosoupape interchangeable in the Avro; and it is relevant to recall that one of the experiments carried out at Gosport in 1917 was the installation of a 130 h.p. Clerget in the 504J B.3157.

A. V. Roe and Co. did in fact devise adaptors by means of which any of the engines could be fitted into the 504 airframe. All were carried on an overhung mounting and had an open-fronted cowling. The modified machine was designated Avro 504K, regardless of the type of engine. Production machines appeared with all these engines, and were distributed to every training unit at home and to others in Egypt, India, Australia and Canada.

It was recognized that the Egyptian climate might affect the wooden airframe adversely, and in 1918 some 504-type wings of steel construction were sent there to observe the effects of the climate on steel stuctures.

Many 504Js were converted to become 504Ks, and machines which had been ordered under contracts for 504As and 504Js were modified during construction to become 504Ks. Production was undertaken on an enormous scale, and the total number of all Avro 504 variants which were built during the war exceeded the production of any other individual type of British aeroplane of the period. In 1918 production of the 504K was initiated in Canada, at the factory of Canadian Aeroplanes Ltd., the Government-sponsored undertaking which had taken over the Curtiss works and staff at Long Branch, Toronto, late in 1916. It seems clear that the intention was for the Avro to replace the Curtiss JN-4 at training stations in Canada, and gives an interesting indication of the official opinion on the relative merits of the two machines. The initial contract was for 100 Avro 504Ks, but only one, or at most two, had been delivered by the time of the Armistice.

The British Liaison Officer in Washington, Col. Lee, was of the opinion that the Avro was the finest trainer ever built, and he had one sent to America during the winter of 1917-18. It made several demonstration flights over Washington. The Americans wanted large numbers of 504Ks but could obtain only a few which they used at Issoudun for instruction in aerobatics.

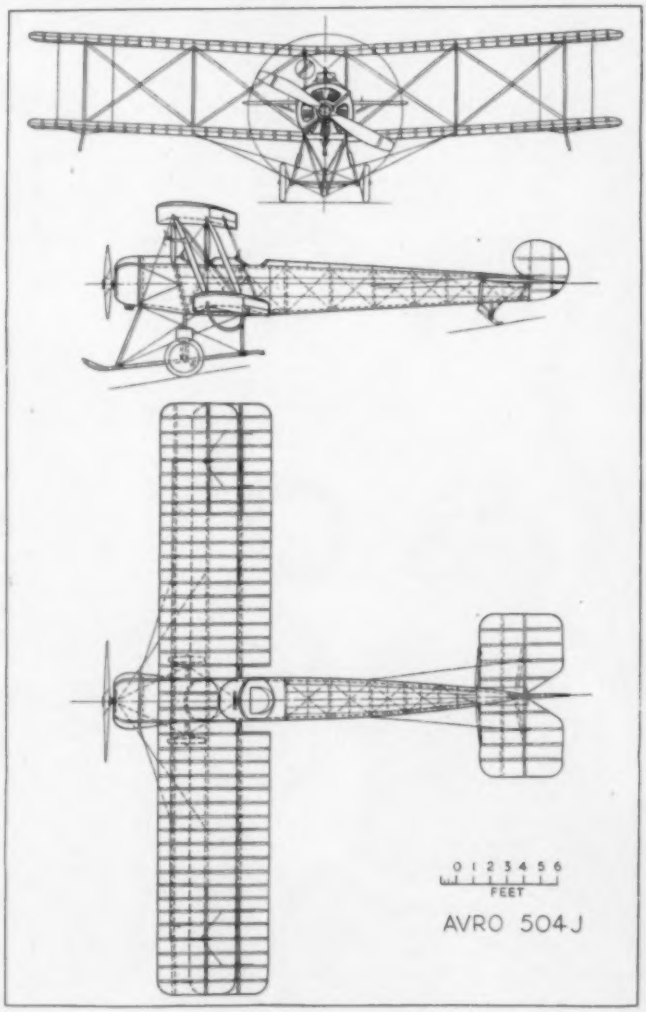
One of the little-known facts in the Avro's history is that the 504K was issued to Home Defence squadrons as a fighting aircraft from the beginning of 1918. By the end of 1917 it had become evident that the F.E.2bs which were in use with some Home Defence units were ineffective because of their low ceiling. It was therefore decided to re-equip the northern group of squadrons with single-seat conversions of the Le Rhône Avro 504K: in this form the type could reach a ceiling of 18,000ft.

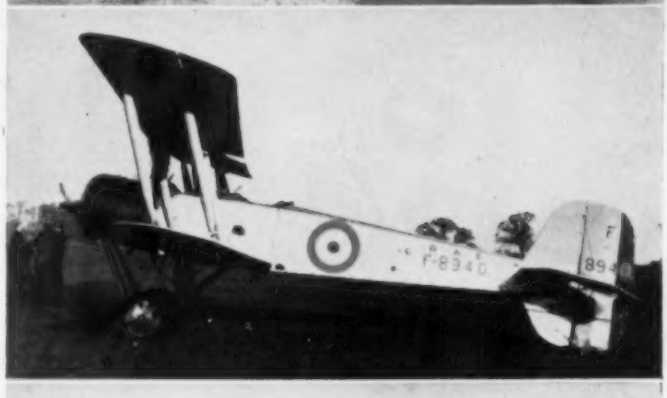
A 504K single-seat fighter conversion for home defence (note Lewis gun on Foster mounting and gravity tank moved out to port).

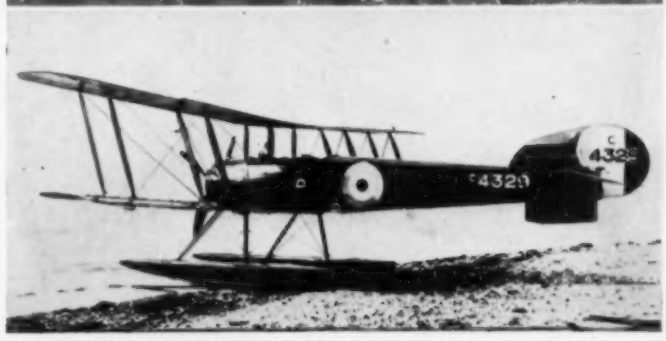
It was also thought that experience gained by pilots in handling the Avro and its rotary engine would make them suitable for later transfer to the Camel-equipped Home Defence squadrons in the south. Avro 504Ks still equipped five squadrons at the Armistice, by which time they were due to be replaced by Sopwith Camels.

The Home Defence Avros were armed with a single Lewis gun on a Foster mounting above the centre-section: a similar installation had been made on the 504J No. C.4364. The front cockpit of the fighter 504Ks was faired over, and the gravity tank was moved out on to the port upper wing to make way for the gun-mounting. In an endeavour to improve their performance, some of the 504K fighters were fitted with a vee undercarriage similar to that of the Avro 521. The vees were attached to the fuselage at the normal pick-up points for the struts which supported the central skid of the standard undercarriage, and were consequently unusually broad.

The Sunbeam Motor Car Co., Ltd., were contractors for the Avro 504A, J and K, and in 1918 they fitted a 504K airframe with one of their own Dyak engines of 100 h.p. There is no record of







Reading down: Avro 504K with Sunbeam Dyak engine; experimental Avro 504K with greatly enlarged tail surfaces and vee undercarriage; 504K with fireproof installation of A.B.C. Wasp radial engine; Avro 504L, with the float undercarriage in its original form.

further British development of the Dyak-powered 504K, but seven Avros with Dyak engines were built in Australia in 1920 by the Australian Aircraft and Engineering Co., Ltd., at Mascot, Sydney, N.S.W. The first Australian Dyak-Avro was delivered to the newly-formed Queensland and Northern Territories Aerial Services Co., Ltd. This Avro proved to be exceptionally reliable in the very trying conditions under which it had to operate. Not the least of its assets was its inboard starting-handle, by means of which the engine could be started from the cockpit.

The last war-time variant of the Avro 504 was a seaplane conversion of the 504K which was designated 504L. Two single-step pontoon floats replaced the wheel undercarriage of the Clerget Avro C.4329, and a tail float was attached directly to the bottom longerons. A fin was added to the tail unit, but was shaped to accommodate the balance area of the original comma-shaped rudder. Each float originally had only two struts to connect it to the fuselage, but an additional strut was later provided to each rear float attachment point.

After the Armistice the Avro 504J and 504K continued in service as the R.A.F.'s standard training aircraft. The 504J was declared obsolete in September 1921, but the 504K carried on for many years. It also helped to lay the foundations of several of the air forces of the Commonwealth countries, to which numbers of British aeroplanes were presented in 1919 as an Imperial Gift.

Australia had bought a small number of 504Ks before the Imperial Gift was made. Of the 100 aircraft received by Australia, 30 were Clerget Avros; the first five, among them E.3745, arrived in Australia during May 1920. These Avros were re-numbered in the original Australian A3 series, and remained in use up to 1929. Six Avro 504Ks were built in Australia in 1922-23.

New Zealand at first refused the Imperial Gift of 100 aircraft in 1919, but in the following year accepted 33, of which 20 were Avro 504Ks. The Avros were lent to private concerns: in 1921-22 the New Zealand Flying School at Auckland had four 504s and one 504L, the Canterbury Aviation Co. had ten 504Ks, and the New Zealand Aero Transport Co. of Timaru had six.

The initiation of production of the Avro 504K in Canada has already been mentioned, and in 1919 the aircraft presented to Canada in the Imperial Gift included 58 Avro 504Ks. These machines were used at Camp Borden, and during the summer of 1927 one was used to test what must have been a remarkable variable-pitch airscrew, for it was fitted to the 130 h.p. Clerget rotary engine. The airscrew was designed by Mr. W. R. Turnbull and was made by Vickers (Canada), Ltd. This Canadian branch of Vickers had also undertaken the production of the Avro 504K at Montreal.

In South Africa, at least six 504Ks were used by the S.A.A.F., and the type was in service until 1929.

Of the 100 aeroplanes given to India in 1919, it is believed that 40 were Avro 504Js or Ks with 100 h.p. Gnôme Monosoupape engines. These machines and the 60 D.H.9s which accompanied them were dumped at Karachi and were ultimately offered for disposal free in order to have them removed. The Royal Air Force took 20 of the Avros on to its strength.

Other countries recognized the Avro's good qualities and adopted the 504K as a training type for their air forces. Holland made its first purchase of 12 504Ks on May 31st, 1919, and bought a second dozen on December 18th, 1919. A further batch of 12 were acquired on November 8th, 1922.

Japan used the Avro as a standard reconnaissance machine; and in 1921 the British Aviation Mission to the Imperial Japanese Navy took with it 20 Le Rhône Avro 504Ks and ten 504Ls powered by the 150 h.p. B.R.1 engine. The Avro company granted manufacturing rights to the Japanese government, and the 504K was produced in Japan.

Also in the Far East, the Peking branch of Vickers, Ltd., supplied some 504Ks to the Chinese air force in 1920.

The 504K was built in some numbers in post-Revolutionary Russia. There it was known as the U-1; and its engine, a copy of the 110 h.p. Le Rhône, was designated M-2.

The greatly reduced peace-time needs of the R.A.F. produced a surplus of hundreds of Avros, and it is no wonder that the type came on to the British Civil Register in large numbers. There were in fact more 504Ks on the register than any other single type of aeroplane until 1929. By that time no fewer than 276 had been given civil registrations.

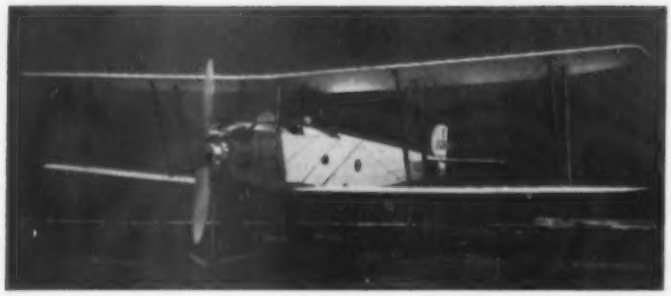
To attempt to record their exploits or to trace the seemingly infinite variety of forms in which the Avro worked as a civil type would entail the writing of a complete book. The machine had much to commend it to those who sought to use aircraft commercially in the post-war years. It was strong, safe, easy to fly and maintain; and, above all, it was immediately available in large numbers and at a reasonable price. Its ability to use small fields made it attractive to the many joy-riding concerns which operated the type.

Down through the years the Avros gave long and faithful service, and acquired an astonishing variety of engines. Many of these modified machines were "one-offs" of the personal variety; but in those cases where the modification was carried out by the Avro company a new type number was usually allotted.

The first of the renumbered Avros was the 536. This was similar to the 504K in appearance, but the fuselage was widened by 9in to accommodate four passengers in two side-by-side pairs in the rear cockpit. The engine was either a 130 h.p. Clerget or a 150 h.p. B.R.1, and occasionally a fin similar to that of the 504L was fitted.

A natural development of the Avro 536 was the Avro 546 Limousine, which had the widened fuselage and 504L-pattern fin, but had the refinement of enclosed accommodation for its passengers: the pilot had an open cockpit. The Avro 546 was powered by a 150 h.p. B.R.1 rotary engine.

The Avro 548 was the 504K airframe modified to carry two



Reading down: Avro 504M; Avro 504N (first prototype); 504N (production), showing blind-flying hood; 504O.

THE AVRO 504 . . .

passengers in the rear cockpit and fitted with either the 80 h.p. Renault or 90 h.p. R.A.F. Ia engine; and the installation of the 120 h.p. A.D.C. Airdisco vee-eight engine was also made, in which form the aircraft was known as the Avro 548A. The fuel system was modified: petrol was carried in two 16-gallon gravity tanks under the upper wings. Twenty-eight 548s went on to the British Civil Register, and one was still in service as late as 1937.

Generally similar to the 548 was the Avro 552, which was the 504K airframe with a 200 h.p. Wolseley Viper engine and float undercarriage. Some Avro 552s were supplied to Bulgaria. The prototype 552/522A was G-EAPR, an Avro which had a most varied career. It had been flown with a 90 h.p. Curtiss OX-5 engine, at which time it had the standard 504K ailerons and undercarriage. It became the Avro 552 when it was fitted with the Wolseley Viper and twin-float undercarriage; it also had the tapered ailerons used on the Avro 504N. The machine was later converted to a landplane with the designation Avro 552A: it was given an oleo undercarriage of the type fitted to the 504N, and at one time had an experimental rudder of rectangular outline. Later still it had a simple vee undercarriage and a standard rudder. This same Avro, G-EAPR, was used in early Autogiro experiments, after which it was abandoned for some years. It was rebuilt as a fixed-wing biplane with the new registration G-ABGO: as a result of the Autogiro experiments both cockpits were behind the centre-section struts; and a standard 504K-type undercarriage was fitted. For a time G-ABGO was owned by the brothers L. J. and L. G. Anderson of Hounslow. They sold it to the Inca Aviation Co., for which concern ABGO towed advertising banners until it was wrecked at Coal Aston in 1933.

Other post-war engine installations were the 100 h.p. Green, 150 h.p. Curtiss, 170 h.p. A.B.C. Wasp radial, 220 h.p. Hispano-Suiza, and the 100 h.p. Bristol Lucifer. The Green installation was characterized by a large spinner on the airscrew, and the radiator was on the leading edge of the centre section. Avros with 150 h.p. Curtiss and 220 h.p. Hispano-Suiza engines were flown in Australia.

Several Avros were fitted with the 100 h.p. Bristol Lucifer three-cylinder radial engine, and were popularly known as "Three-pot Avros." The first combination of an Avro and a Lucifer was made while the engine was yet known as the Cosmos Lucifer, and the machine first flew on December 11th, 1919, piloted by Capt. Norman Macmillan. The combination proved successful, and a few other Lucifer-Avros appeared in later years with varying engine installations, ailerons and undercarriages. One of the most interesting was G-EAJB, which had given long service as a Renault-powered Avro 548 of the Henderson School of Flying. It was fitted with a Lucifer engine and tapered ailerons; and the main undercarriage legs had the oleo shock-absorbers of the 504N despite the retention of the usual central skid.

One of the installations of the A.B.C. Wasp radial was made in D.9308 for experiments in reducing fire risks in aircraft. The experiments were conducted by Sqn. Ldr. G. H. Norman in 1920; and the Avro ultimately had a fuel tank under each lower wing in line with the inner bay of struts.

Another radial engine installation was that of the 100 h.p. Anzani in G-EBWO, an Avro specially built in 1928 by the Henderson School of Flying for one of their pupils.

Avro 504Ks were used in a number of other experiments, particularly with control surfaces. In 1924 two Avros, F.8940 and H.2402, were fitted with greatly enlarged vertical tail surfaces for experiments in the determination of lift and drag at large angles of attack. The very large fin and rudder had a total area of about 30.5 sq ft in order to provide control at angles of attack as great as 28 degrees. The machines were fitted with a vee undercarriage of the type used on the single-seat fighter 504Ks; and H.2402 had a ballast tank, fitted with an emergency release, mounted in the tail of the fuselage. This tank was connected to another in the observer's cockpit, from which a known quantity of water was run back before the gliding tests began. The weight of water in the tail enabled the pilot to hold the aeroplane at large angles of attack. The experiments terminated prematurely when H.2402 crashed on landing.

The Avro 504K went abroad to many lands for civil purposes; to Belgium, Guatemala, Cuba, Norway and Sweden, where it was flown on skis; and even to America, where at least three were on the early Underwriters Laboratory Register.

The basic Avro 504 design theme continued. In 1919 the 504M appeared, an enclosed three-seat touring aeroplane which could have either the 110 h.p. Le Rhône or 150 h.p. B.R.1 engine. The type never became popular.

The first Avro 504N appeared in 1922. This was E.9265, a 504K (built by Grahame White) modified to have a 150 h.p. Armstrong Siddeley Lynx radial engine. Tapered ailerons were fitted, but the original central skid undercarriage was retained. The 504N was ultimately accepted as a replacement for the 504K as the standard R.A.F. trainer, and production 504Ns were built up to 1931. They had a modified undercarriage of characteristic design with oleo-pneumatic shock-absorbers; and the main fuel tanks were under the upper wings: the sides of the fuselage were given more rounded fairings. Lynx engines of 160, 180 and 215 h.p. were successively fitted; and Frise ailerons, reverting to the original rectangular form, were also fitted to the late 504Ns.

In their turn the 504Ns came on to the Civil Register, many with the 150 h.p. Armstrong Siddeley Mongoose five-cylinder radial engine; and like the 504K before it the 504N was widely used for joy-riding. It was also familiar to the general public as a banner-towing aircraft for advertising purposes.

The 504N gave rise to further derivatives. A hybrid aircraft consisting of a 504N airframe with a 130 h.p. Clerget rotary was designated Avro 504K Mark II: several were built, and two were registered as G-ADGM and 'GN as late as 1935.

The Avro 582 Tourer of 1927, G-EBKQ, consisted of a

504N fuselage fitted experimentally with special thick high-lift wings and single-bay struts. The wings were of symmetrical aerofoil section, but their dimensions were similar to those of the standard wings. Only the lower wings had ailerons, and a simplified undercarriage was fitted. This aeroplane was also flown with standard 504N wings and undercarriage, and powered by the 200 h.p. Bristol Titan five-cylinder radial engine. In yet another form, it flew as a twin-float seaplane, and as such it was used by Air Service Training at Hamble. Its floats were long boat-built structures, and there was no tail-float.

The Avro 504O was a floatplane version of the 504N, powered by the Armstrong Siddeley Lynx IVc. Some machines had a fin like that of the 504L. The 504P was a side-by-side two-seat trainer, and the 504Q was a twin-float seaplane with enclosed accommodation for passengers, which was made for the Oxford University Polar Expedition.

The 504R, or Avro Gosport, first appeared in the spring of 1926. An improved model of the 100 h.p. Gnôme Monosoupape powered the earliest 504Rs, and the cowling had a large diameter frontal aperture. Later machines had the 100 h.p. Bristol Lucifer and 150 h.p. Armstrong Siddeley Mongoose. The basic airframe was again that of the Avro 504K, with the faired fuselage sides of the 504N and modified cockpit coamings. The fuel system varied, and some 504Rs had new interplane struts of narrow chord. Tapered ailerons and narrow-chord centre-section were standard. The Lucifer-powered 504R was re-designated 504S, and was the ultimate 504 variant.

In December 1926 Hinkler and Leeming made a landing on the summit of Helvellyn in a modified Avro 504R, G-EBPH. Their machine had the Avro Alpha five-cylinder engine of 100 h.p., and an undercarriage of 504N type.

In one form or another, the Avro 504 gave service somewhere in the world until the outbreak of the second World War. Even then some 504Ns were still in service with the Greek Air Force. The comparative brevity of this history has precluded mention of all the forms in which the Avro 504 flew, and it has given little or no indication of what, for want of a better word, might be termed the personality of the Avro 504. Its ubiquity was perhaps inevitable, but that alone cannot account for the very real affection with which it is regarded by all who flew it.

One or two 504Ks are, fortunately, with us still and one at least is occasionally airborne; but British skies are the poorer now that they are no longer graced by the elegant form and dignified progress of this great aeroplane.

PRODUCTION

Manufacturers.—A. V. Roe and Co., Ltd., Clifton Street, Miles Platting, Manchester; and at Hamble.

Other Contractors.—Blériot and Spad Aircraft Works, Addlestone, Surrey; Brush Electrical Engineering Co., Ltd., Loughborough; Eastbourne Aviation Co., Ltd., Eastbourne; Grahame White Aviation Co., Ltd., Hendon, London; Harland and Wolff, Ltd., Belfast; Henderson Scottish Aviation Factory; Hewlett and Blondeau, Ltd., Oak Road, Leagrave, Luton; Humber Motor Co., Ltd., Coventry; Morgan and Co., Leighton Buzzard; Parnall and Sons, Mivart Street, Eastville, Bristol; Regent Carriage Co., Ltd., Fulham; Frederick Sage and Co., Ltd., Peterborough and London; S. E. Saunders, Ltd., East Cowes, Isle of Wight; Savages, Ltd., King's Lynn, Norfolk; Sunbeam Motor Car Co., Ltd., Wolverhampton; Canadian Aeroplanes, Ltd., Toronto, Ontario, Canada; Australian Aircraft and Engineering Co., Ltd., Sydney, N.S.W.

PRODUCTION AND ALLOCATION

During the war period, 8,340 Avro 504s were produced. Of these, 3,696 were built by A. V. Roe and Co., Ltd., and 4,644 by other contractors. Deliveries to the R.F.C. and R.A.F. totalled 5,446, of which 4,771 went to Training Units, 274 to Home Defence Units, 9 to the Expeditionary Force (in 1914 only), and 392 to the Middle East Brigade.

On 31.10.18 there were 2,999 Avros on charge of the R.A.F. Ten were at Aeroplane Repair Depots; 16 in store; 10 at Aircraft Acceptance Parks; 2,267 were at Flying Schools and various Home Establishment aerodromes; 226 were with Home Defence squadrons; 184 were with the 11th (Irish) Group; 111 were in Egypt and Palestine; and 175 were destined for Middle East Stations.

SPECIFICATION

Power Plant.—*504 prototype:* 80 h.p. Gnôme, later 80 h.p. Gnôme Monosoupape. *Production 504:* 80 h.p. Gnôme. *504A:* 80 h.p. Gnôme. *504B:* 80 h.p. Gnôme, 80 h.p. Le Rhône. *504C and 504D:* 80 h.p. Gnôme. *504E:* 100 h.p. Gnôme Monosoupape. *504F:* 75 h.p. Rolls-Royce Hawk. *504G and 504H:* 80 h.p. Gnôme. *504J:* 100 h.p. Gnôme Monosoupape, 80 h.p. Le Rhône. *504K:* 100 h.p. Gnôme Monosoupape, 110 h.p. Le Rhône, 130 h.p. Clerget, 100 h.p. Sunbeam Dyak. *504L:* 130 h.p. Clerget, 150 h.p. Bentley B.R.1.

Dimensions.—Span, 36ft; length, 29ft 5in (28ft 11in with Sunbeam Dyak); height, 10ft 5in; chord, 4ft 9¾in; gap, 5ft 6in; stagger, 24in (except 504E); dihedral, 2 deg 30 min; incidence, 4 deg; span of tail, 10ft; airscrew diameter, 9ft; wing area, 330 sq ft.

Weights (lb)

	Empty	*Mil. Load*	*Fuel and Oil*	*Loaded*
504 prototype ...	—	—	—	1,550
504 floatplane ...	1,070	—	—	1,719
504 production ...	924	—	—	1,574
504K, Mono-Gnôme	1,100	450	250	1,800
504K, Le Rhône ...	1,231	360	238	1,829
504K, Dyak ...	1,270	350	207	1,797

PERFORMANCE

	S.L.	*Max. speed at:— 6,500ft*	*8,000ft*	*10,000ft*
504 prototype	81	—	—	—
504 floatplane	75	—	—	—
504 production	82	—	—	—
504A	—	62	—	—
504K, Mono-Gnôme ...	—	82	—	75
504K, Le Rhône	95	—	87	85
504L, Clerget	90	—	—	—

Climb to 3,500ft: 504, 7 min (with 80 h.p. Gnôme Monosoupape); 504A, 9 min 30 sec; 504K (Le Rhône), 5 min. To 6,500ft: 504A, 25 min. To 8,000ft: 504K (Le Rhône), 10 min. To 10,000ft: 504K (Le Rhône), 16 min.

Reading down: Avro 504Q; 504R Gosport; 552A, with Wolseley Viper engine and vee undercarriage; 582 Tourer.

THE AVRO 504 . . .

Service Ceiling: 504K (Monosoupape) 13,000ft; 504K (Le Rhône) 16,000ft.

Endurance: Prototype, 3 hr; 504A, 4½ hr; 504C and D, 8 hr; 504K (Monosoupape), 3 hr. 504K (Dyak), 2½ hr.

Tankage: Petrol 25½ gallons; oil 6 gallons (on 504K).

ARMAMENT

In the early days of the war the observer carried a rifle, and a few home-made gun-mountings of various kinds were used in the field to enable the observer to use a Lewis machine-gun. The early service 504 carried four 20-lb bombs, as also did some of the Home Defence Avros. For anti-Zeppelin work incendiary bombs and grenades were carried.

Some Avro 504Cs had a Lewis gun firing upwards at an angle of about 45 deg through an aperture in the centre-section. Home Defence single-seaters had a Lewis gun on a Foster mounting above the centre-section.

The 504G had a fixed synchronized Vickers machine-gun for the pilot, and a Lewis gun on a Scarff ring-mounting was fitted to the rear cockpit.

SERVICE USE

France: Avro 504 used by R.F.C. Sqns Nos. 1, 3 and 5. R.N.A.S. Sqn No. 3 (one Avro was received by this unit on 27.11.14: on 6.2.15 two were on this squadron's strength). R.N.A.S. Sqn No. 1 (eight Avros were delivered to this unit mid-December 1914: five were on strength on 26.2.15). *Dardanelles:* No. 2 Wing R.N.A.S., Isle of Imbros. *Home Defence:* R.F.C. Sqns Nos. 33, 51, 75, 76, 77 and 90. R.N.A.S. Stations Westgate, Great Yarmouth. *Training Duties:* Before the end of 1918 the Avro 504 had been issued in one form or another to every training unit in Great Britain. Trainer versions were used at the Royal Aircraft Park, Farnborough, and at the Schools of Aeronautics at Bath, Bristol, Cheltenham, Denham, Oxford and Reading; at Flying Instructors' Schools at Gosport (S.W. Area), Shoreham (S.E. Area), Lilbourne (Midland Area), Redcar (N.E. Area), Ayr (N.W. Area) and Curragh (Ireland). Used by squadrons working up before going overseas; e.g., Nos. 24, 45, 65. No. 45 Sqn had six Avros on 30.3.16. Used for night-flying training by Sqns Nos. 186, 188 and 190, R.A.F., at East Retford, Throwley and Newmarket respectively. Used by the R.N.A.S. at Cranwell, Chingford, Frieston, Redcar, Port Victoria, War School at Manston. *Egypt:* 20th Training Wing, Abu Qir. *Australia:* Australian Flying Corps School, Point Cook. *Canada:* Camp Borden, Ontario. *New Zealand:* 504Ks used at flying schools after the war. *South Africa:* Used by the S.A.A.F. after the war. *American Use:* In July 1918 fifty-two Le Rhône-powered 504Ks were purchased by America for the use of the A.E.F. as trainers. Some were used at the A.E.F. 3rd Instruction Centre, Issoudun. *France:* Four Gosport instructors and four Mono-Avros were sent to France in 1918 to advise and assist in the training of French pilots.

SERIAL NUMBERS AND MANUFACTURERS (WHERE KNOWN)

Nos. 179, 383, 398, 568: 504s built by A. V. Roe. 750-793: 504s built by A. V. Roe. 873-878: 504s built by A. V. Roe. 1001-1050: 504Bs built by A. V. Roe: 1467-1496: 504Cs built by Brush Electrical Engineering Co. 2890-2939: 504As built by A. V. Roe. 3301-3320: 504Cs built by Brush Electrical Engineering Co. 4020-4069: 504As built by A. V. Roe. 4737-4786: 504As built by A. V. Roe. 7446-7455: 504As built by A. V. Roe. 7716-7739: 504As built by A. V. Roe. 7943-7992: 504As built by A. V. Roe. 8574-8603: 504Cs built by A. V. Roe. 9276-9285: 504Es built by A. V. Roe. 9821-9830: 504Bs built by A. V. Roe. 9861-9890: 504Bs built by Parnall.

A.412-A.461: 504As built by Saunders. A.462-A.511: 504As built by Blériot and Spad. A.512-A.561: 504As built by A. V. Roe. A.1970-A.2019: 504As built by Blériot and Spad. A.2633-A.2682: 504As built by A. V. Roe. A.3355-A.3404: 504As built by Saunders. A.5900-A.5949: 504As built by A. V. Roe. A.8501-A.8600: 504As built by A. V. Roe. A.9763-A.9812: 504As and Js built by Saunders.

B.901-B.1000: 504As and Js built by A. V. Roe. B.1390-B.1394 and B.1397-B.1400: Avros renumbered on transfer to the R.F.C. from the R.N.A.S. B.3101-B.3250: 504As and Js built by A. V. Roe. B.3251-B.3300: 504As built by Humber. B.4201-B.4400: 504As and Js ordered from A. V. Roe; B.4351-B.4400 were not built. B.8581-B.8780: 504As and Js built by Parnall. B.8781-B.8830: serial numbers originally allotted for Avros, but contract cancelled.

C.551-C.750: 504As built by Humber. C.4301-C.4500: 504Js built by A. V. Roe. C.5751-C.6050: 504Js and Ks built by Harland and Wolff.

D.1-D.200: 504Js and Ks built by A. V. Roe. D.1601-D.1650: 504As built by Eastbourne Aviation Co. D.1976-D.2125: 504K (Clerget) built by Sage. D.4361-D.4560: 504Js built by Sunbeam. D.5451-D.5550: 504Js and Ks built by A. V. Roe. D.5851-D.5950: 504Ks (Clerget) built by Henderson Scottish Aviation Factory.

D.6201-D.6250: 504As and Ks built by Humber. D.6251-D.6400: 504Js and Ks built by Brush Electrical Engineering Co. D.7051-D.7200: 504Ks (Clerget) built by Hewlett and Blondeau. D.7501-D.7800: 504Js and Ks built by A. V. Roe. D.8251-D.8300: 504As and Ks built by A. V. Roe. D.8781-D.9080: 504Ks built by Grahame White. D.9281-D.9380: 504Ks built by Parnall.

E.301-E.600: 504Ks built by Harland and Wolff. E.1601-E.1900: 504Js and Ks built by A. V. Roe. E.2901-E.3050: 504Ks built by Morgan and Co. E.3051-E.3150: 504Ks built by Savage and Co. E.3254-E.3403: 504Ks built by Parnall. E.3404-E.3903: 504Ks built by A. V. Roe. E.4104-E.4303: 504Ks built by Humber. E.4324-E.4373: 504Ks built by Eastbourne Aviation Co. E.6737-E.6786: 504Ks built by Morgan and Co. E.9207-E.9506: 504Ks built by Grahame White.

F.2233-F.2332: 504Ks built by Brush Electrical Engineering Co. F.2533-F.2632: 504Ks built by Sunbeam.

H.2146-H.2645: 504Ks built by A. V. Roe. J.731-J.1023 (possibly to J.1230): 504Ks and Ns built by A. V. Roe.

There were other batches of 504Ks within and about the range F.8727-F.8940 (the complete batch may have been F.8696-F.8945), of which F.8864-F.8882 are known to have been built by Fredk. Sage; within and about F.9697-F.9922, of which F.9810 is known to have been built by Hewlett and Blondeau; within and about H.1925-H.1970, of which H.1964 and H.1966 are known to have been built by Sunbeam; within and about H.2956-H.3214 (the complete batch may have been H.2946-H.3245) of which H.2987-H.2990 are known to have been built by Brush; within and about H.5196-H.5241, of which H.5240 and H.5241 are known to have been built by Eastbourne; and H.244, H.6630, H.7531, H.9816, H.9840 and H.9847 are all believed to have been 504Ks; while H.5196 became a 504N.

There were also much later 504Ks in the J series, e.g., J.8332, J.8333, J.8875.

N.5250-N.5279: 504Bs built by Sunbeam. N.5310-N.5329: 504Bs built by Regent Carriage Co. N.5800-N.5829: 504Bs built by Parnall. N.6010-N.6029: 504Bs built by Parnall. N.6130-N.6159: 504Bs built by Sunbeam. N.6650-N.6679: 504Bs.

Notes on Individual Machines.—179, 873, 874, 875: the four 504s sent to Belfort to bomb the Zeppelin sheds at Friedrichshafen, 21.11.14. 383: No. 5 Sqn 568: No. 5 Sqn. 753: interned in Holland. 876: R.N.A.S. Chingford. 1001: interned. 1019: had 80 h.p. Le Rhône. 1028: R.N.A.S. Cranwell. 1031: R.N.A.S. Chingford, later Cranwell. 1032, 1033, 1034: R.N.A.S. Chingford. 1033 had 80 h.p. Le Rhône. 1043: No. 2 Wing R.N.A.S., Imbros. 1492, 1493, 1494: R.N.A.S. Cranwell.

2905: left works 17.1.16, used for fabric tests at Farnborough in 1916. 2929: R.N.A.S. Redcar. 2930: fitted with fin of 3307, crashed at Cranwell. 2933, 2934: R.N.A.S. Redcar. 3302, 3318: R.N.A.S. Cranwell. 4043, 4044: transferred to R.N.A.S. 4741: No. 23 Sqn. 4784, 4785: left works 22.8.16. 7944: left works 30.6.16. 7946: left works 1.7.16. 7960, 7961: left works 21.7.16. 7963, 7964: left works 26.7.16. 7987: left works 30.8.16 7990: left works 31.8.16. 8594, 8600: R.N.A.S. Redcar. 8603: modified to have 75 h.p. Rolls-Royce Hawk, redesignated 504F. 9277: R.N.A.S. Chingford. 9278: R.N.A.S. Cranwell. 9821, 9822: R.N.A.S. Cranwell. 9862, 9863, 9864: R.N.A.S. Cranwell. 9865, 9866, 9867: R.N.A.S. Redcar. 9870, 9875: R.N.A.S. Cranwell. 9880: R.N.A.S. War School, Manston. 9890: fitted with interrupter gear.

A.426: No. 31 Training Sqn, Wyton. A.85 5: No. 35 Reserve Sqn, Northolt. A.8515: used at Harling Road aerodrome. A.9785: No. 51 Sqn.

B.3182: used at Harling Road aerodrome. B.4309, B.4310: transferred to R.N.A.S. without engines. B.4311-B.4317: transferred to R.N.A.S. with 80 h.p. Gnômes.

C.572: "5" at London Colney, crashed by Lt. Le Feuvre, May 1918. C.4329: prototype 504L. C.4436: No. 31 Training Sqn, Wyton.

D.13: Used by American Cadets at Brinstead Manor. D.4388: "A," No. 10 Training Squadron, Gosport. D.4441: "B," No. 10 Training Sqn, Gosport. D.7051: "S," No. 10 Training Sqn, Gosport. D.7601: delivered to School of Special Flying, Gosport, April 1918. D.7608: School of Special Flying, Gosport. D.7613: Delivered to School of Special Flying, Gosport, April 1918. D.7999: "B" Flight, No. 186 Development Sqn, Gosport, 1919. D.9038: 1668 of A.E.F. purchase.

E.1621: No. 186 Development Sqn, Gosport, 1919. E.1807: Hamble, 1918. E.1830: No. 186 Development Sqn, 1919. E.3493: as ER.3493 crashed at No. 4 F.T.S. E.3567: C.F.S. Upavon. E.3746: presented to Australia. E.3763: "A" Flight, No. 186 Development Sqn, 1919. E.3778: Hamble, 1918. E.3800: "F" Flight, No. 186 Development Sqn, 1919. E.9261, E.9265, E.9266, E.9268: all became 504Ns; E.9265 was first prototype. E.9384: "DON," Australian Flying Corps Station, Leighterton.

N.5261: fitted with interrupter gear. N.5264: R.N.A.S. Redcar. N.5266: R.N.A.S. Redcar. N.5267: fitted with interrupter gear. N.5271: R.N.A.S. Cranwell. N.6015-N.6029: transferred to the R.F.C. N.6158: R.N.A.S. Frieston. N.6654: R.N.A.S. Cranwell. N.6666: R.N.A.S. Cranwell.

Avros of the School of Special Flying, Gosport.—*"A" Flight:* B.3165, B.3169, C.609, C.4451, D.41. *"B" Flight:* B.3172, B.4222, B.4223, B.4246, C.608, C.4344, C.4447. *"C" Flight:* B.987, B.3101, B.3131, B.3167, B.4263, C.4448, C.4450, C.4452, D.6266, D.6269. *"D" Flight:* A.9811, B.3102, B.3155, B.3159, B.3174, B.3196, B.4242, B.4249, B.4250, B.4266, C.606, D.6270. *"E" Flight:* A.9799, B.3158, B.4265, B.4243, C.4432, C.4433, D.6267. *"F" Flight:* A.9810, A.9812, B.3104, B.4245, C.4431, C.4449, D.42, D.7603. *H.Q. Flight:* D.6268, D.7601-D.7613: 504Ks delivered during April 1918.

Avros in New Zealand, 1921-22.—Most, if not all, of the following machines were probably included in the Imperial Gift of aircraft. Where an aircraft went on to the New Zealand Civil Register its registration letters are given in parentheses following the serial number.

New Zealand Flying School, Auckland: 504Ks—H.2986, H.2988, H.2989 (G-NZAA), H.5240 (G-NZAB); 504L—H.2990 (G-NZAC).

Canterbury Aviation Co., Christchurch: 504Ks—D.6243, E.4237, E.4242 (G-NZAK), E.9432 (G-NZAF), H.1952, H.1958, H.1964 (G-NZAG), H.1968, H.1970, H.2987 (G-NZAJ).

N.Z. Aero Transport Co., Timaru: 504Ks—E.3142 (G-NZAN), E.9424 (G-NZAP), E.9427 (G-NZAR), E.9429, H.1966 (G-NZAL), H.5241 (G-NZAO).

COSTS

Avro 504K airframe less engine and instruments, £868 19s; 100 h.p. Gnôme Monosoupape engine, £696; 110 h.p. Le Rhône engine, £771 10s; 130 h.p. Clerget engine, £907 10s.

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

The Nash Collection Camel

ACCORDING to the Royal Aeronautical Society, it has not been possible to trace the histories of the aircraft of the Nash Collection it has acquired.

I can help so far as the Sopwith Camel is concerned, because this machine was once my property and I was its first private owner. I bought it, less engine, in the early twenties from the Aircraft Disposal Company at Waddon with the intention of converting the airframe to take a radial engine instead of the 130 h.p. Clerget. This conversion I carried out, installing a 40-45 h.p. six-cylinder Anzani, the only power unit I could get. This engine had been used previously in a little ANEC biplane belonging to the late Mr. Warwick, who lost his life while flying it in the King's Cup Race.

I found the Camel woefully underpowered with the Anzani when I flew some straights with it, and the rudder area was inadequate. Capt. van Oppen, one-time pilot of Hillman Airways and British Airways, also flew it a bit. I sold it to an enthusiast who towed it by a small Fiat car from a farm near Tring, Hertfordshire, all the way to his home in North Wales.

How many times the aircraft changed hands I do not know, but I recall that it was built by Boulton and Paul at Norwich.

The Lafayette Escadrille markings on the fuselage, applied by one of its owners, were presumably for display purposes, for obviously the machine never went into service; and, to the best of my knowledge, that squadron was equipped only with Nieuports and Spads.

London, S.W.1. GRENVILLE MANTON.

Hendons and Virginias

THE letter from Mr. M. J. F. Bowyer in your April 30th issue has certainly struck a few sparks of nostalgia. For my part the Fairey Hendon will live as the equipment of my first squadron (No. 38) who, I believe, were the only squadron to have them, converting to them from the Heyford.

I wonder how many remember the perils of climbing that rickety ladder, or climbing aboard with new accumulators over the tail gun ring—quite a feat. In 1939 we re-equipped with the faithful old "Wimpey."

The Hendons (or some of them at least), although denied a flying part in the late war, gallantly did their bit by helping to train the stream of eager young men pouring through the wireless school at Cranwell, where they were used to teach aircraft wiring.

I cannot speak for more than one "Ginny," but one came to our airfield in the very early days of the war, doing parachute training and testing. I wonder how many remember the scratches on their outboard struts caused by last-minute but unavailing changes of mind of a parachutist who wished he hadn't pulled the string! It all seems so very long ago now.

Welling, Kent. D. L. HART.

More Dam-busting

I HAVE read with considerable interest your two-page feature on our film "The Dam-Busters" contained in your issue of June 18th, 1954.

Your comment in the caption describing the "white" Wellington aircraft infers that the Wellington used on that occasion should not have been white in colour but instead should have been camouflaged in the usual war-time manner. I must respectfully point out that when the eminent scientist Dr. Barnes Wallis flew to Scampton from Weybridge on the actual occasion, the Wellington used was exactly of the colour as seen in the photograph—white, or to be precise, silver.

Our policy throughout research, pre-planning and production of "The Dam-Busters" has been, and still is, to contain within the framework of Mr. R. C. Sherriff's screenplay complete authenticity. In permanently recording on film such an historic event as the dams raid we all of us at Elstree feel it incumbent on us to keep as close to the facts as is possible. In addition, I should point out that with us here all the time during filming we have the invaluable assistance of Group Captain J. C. Whitworth, D.S.O., D.F.C., who was Station Commander at Scampton at the time of the actual raid in 1943. Group Captain Whitworth was present on the airfield when Dr. Barnes Wallis arrived in the Wellington and I should like to say here that his first-hand knowledge of the Ruhr dams raid—from the initial planning right through to its successful completion—is proving invaluable to us. I make this point about the colouring of the Wellington not in any spirit of recrimination but merely to assure you and your readers that we are endeavouring to ensure that this film is as authentic a record as possible and is in every way worthy of the fine spirit and imperishable gallantry shown by the men of Bomber Command who flew on the dams raid.

May I conclude by thanking you for your interest in what we feel and hope will be a great British film and a fitting tribute to the gentlemen of 617 Squadron. LESLIE FREWIN,

Elstree, Herts. Associated British Picture Corpn., Ltd.

[Our comment was inspired not by the colour of the Wellington—which is correct, except for the yellow bands—as by the fact that it was a post-war T.Mk.10 machine.—Ed.]

Remembering F. P. Raynham

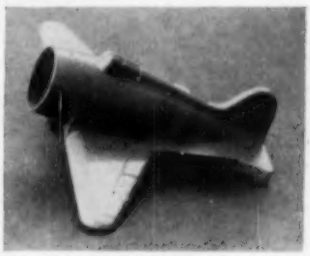
I WAS very interested to read the article which appeared in the June 18th issue on the late F. P. Raynham. With reference to the passenger who accompanied him in February 1914, when the British height record for pilot and one passenger was broken, I think the name should read R. J. McGeagh Hurst, my brother-in-law, who was a great friend of the late Mr. Raynham.

Mr. Hurst is still alive and resides in Devon; he himself holds an early Royal Aero Club Pilot's Certificate; and, as a matter of interest, it may be added that he observed Mr. Lankester Parker when he qualified for his certificate.

Belfast. M. HOWARD.

Putting too Fine a Point on It?

IN your issue dated October 23rd, 1953 (p. 570), you published a letter and photograph by Mr. I. C. Morton describing a plastic model Comet with U.S. military markings.



You entitled the item "Shape (Roughly) of Things to Come?" Perhaps the enclosed photograph [reproduced here—Ed.] represents a new phase in East-West relations, for, as it reveals, we have what might be mistaken for a World War 2 Russian I-16 fighter! The imagination has no great need of being stretched, for on the "fuselage" of this quite efficient plastic pencil-sharpener is the clue "Made in Germany."

London, S.W.5. CHARLES W. CAIN.

IN BRIEF

Giving quotations from a number of advertisements which appeared in *Flight* during 1910, Mr. C. A. McKenzie Child wonders if any older readers can recollect details of the Boyd engine, to which they referred. One of the announcements stated: "All-British invented and constructed. This engine has not been culled from other existing engines. Something everybody has been looking forward to for years. It is something quite new. Each cylinder is an engine in itself. It is the result of seven years of experiments. . . . Weight per h.p. cannot be approached by any other engine." (It is our own impression—though we are open to correction—that the Boyd engine never got beyond the experimental stage).

FORTHCOMING EVENTS

July 17-24. International Gliding Exhibition, London.
July 18. Yorkshire Aeroplane Club: "At Home," Sherburn-in-Elmet.
July 18-25. Aero Club of Italy: International air week.
July 20-Aug. 4. B.G.A.: World Gliding Championships, Great Hucklow, Derbyshire.
July 24-26. World Model Aircraft Championships and Wakefield Trophy, Washington, U.S.A.
July 31. Ulster Flying Club: Newtonards rally.
July 31-Aug. 4. Trento Aero Club: Seventh air tour of the Dolomites.
Aug. 1-2. Vintage Aeroplane Club: Air rally and Chiltern air race, Denham.
Aug. 2-7. Aero Club de France: World parachuting championship, St. Yan, Saône et Rhône.
Aug. 6-8. Royal Danish Aero Club: Invitation rally.
Aug. 9-11. Institute of the Aeronautical Sciences: Conference on turbine-powered air transport, Seattle, U.S.A.
Aug. 14. Royal Aero Club: National air touring competition, Cranfield.
Aug. 28. Southern Aero Club: Goodyear Trophy race, Shoreham.
Sept. 7-12. S.B.A.C. Farnborough display and exhibition.
Sept. 9-12. Royal Aero Club: International invitation air rally, White Waltham.

THE INDUSTRY

Bristol Apprentices' Prizegiving

THE annual apprentices' prizegiving was held at the Bristol Aeroplane Company's factory at Filton on June 26th. The numerous prizes and certificates were awarded to apprentices in the aircraft, engine and car divisions by Sir Norman Kipping, J.P., M.I.E.E., M.I.P.E., Director General of the F.B.I.

Sir Reginald Verdon-Smith, joint managing director of the company, said in his address that the training programme was in many respects regarded as even more important than other aspects of the company's work. Progress was being made in a wide range of activities—in development work, factory expansion and world sales effort—which meant that new responsibilities and opportunities, requiring more skill and brains, awaited the coming generation. The new extension to the Bristol apprentices' school should be in use later this year, and a start was to be made soon on the central basic workshop which was to be the second stage of the building.

In his report, Mr. A. R. O. McMillan referred to a total of 253 successes in external examinations—80 more than last year. Seven university entry scholarships had also been won.

A Dunlop Appointment

IT is announced that Mr. J. Wright, director and general manager of the Dunlop Rim and Wheel Company, Ltd., Coventry, has been appointed a director of the Dunlop Rubber Co., Ltd.

Mr. Wright joined Dunlop in 1919 as a junior draughtsman in the experimental department at Fort Dunlop. He became manager of the aviation division at Coventry in 1934 and was made director and general manager of the rim and wheel works ten years later. He was appointed as an O.B.E. in 1949 for services to the aviation industry.

Tiltman Langley's New London Office

THE new London offices of Tiltman Langley Laboratories, Ltd., of Redhill, were recently opened at 70-71 New Bond Street, W.1. The premises include a full-scale layout drawing office, in which a lithographic process is being used to prepare detail plates for lofting for various aircraft firms.

It is of interest that Mr. A. Hesseil Tiltman, the company's chairman, prepared the first complete survey of full scale layout methods in this country for the S.B.A.C. in 1943, after visiting the United States. Mr. Marcus Langley (managing director) was a member of the S.B.A.C. sub-committee which subsequently proposed a standardized layout system for the British aircraft industry.

With the opening of the new offices, Tiltman Langley are undertaking drawing, tracing and full-scale layout contracts. Although these are at present concerned mainly with the aircraft industry, the company believes that full-scale layout, either lithographic or photographic, can be applied with advantage to other industries where sheet metal is involved. The introduction of the rubber bolster and simple dies in press work has increased the scope of full-scale layout, and the use of lithographic and photographic methods for reproducing layouts on a wide variety of surfaces has considerably widened its field of application. The main advantages of these methods of reproduction are a reduction in the time normally required in drawing office, tool-room, inspection department and on the assembly lines, obtained mainly by the elimination of duplicated operations.

Pyrene Crash Tender Order

A SUBSTANTIAL order has been placed with the Pyrene Company by the M.o.S. for aircraft crash tenders fitted with a new high-capacity mechanical foam generator. The tenders are built on a Thornycroft Nubian chassis, fitted with a Rolls-Royce B.80 engine of 160 b.h.p. A foam monitor with a range of up to 114ft, mounted on the driver's cab, can be instantly brought into operation as soon as the tender reaches the scene of action. In addition, there are four 60ft lines of foam-delivery hose. A total foam output of no less than 6,000 gallons in 90 sec can be achieved compared with the 2,500 gal/min capacity of the previous equipment. Again, earlier tenders required nine seconds to go into operation; the new foam-generating device can be in operation by the time the tender draws to a halt.

Vickers-Armstrongs Appointment

THE appointment has been announced of Mr. Peter Blandford, B.A., B.Eng., A.F.R.Ae.S., as assistant service manager of Vickers-Armstrongs, Ltd., Aircraft Division. Mr. Blandford, who is 38, was educated at Malvern College and Trinity Hall, Cambridge, and subsequently took a mining engineering degree at Sheffield. He joined the R.A.F. at the outbreak of the war, and, after serving as a bomber pilot, transferred to the Technical Branch; in 1943 he joined the aircraft design branch of D.T.D. in the Ministry of Aircraft Production, and again transferred, in 1945, to the Civil Aircraft Research and Development Section of the Ministry of Supply. He joined Vickers-Armstrongs project offices in 1946 and has since been in their design office and in the guided weapons department at Weybridge.

IN BRIEF

Two British firms, Auto Diesels, Ltd., and Crompton Parkinson, Ltd., have secured "a substantial order" from the United States Government for the delivery of mobile ground power units for the starting of jet aircraft. Value of the equipment, which is for the use of the Western Union air forces, is over ½ million dollars.

* * *

Mr. J. G. Renton has recently been appointed sales manager of Helliwells, Ltd., of Walsall. His appointment is concerned with the extension programme which the company are undertaking at the present time; this includes the opening of a sales office at 5, Clarges Street, London, W.1, and moves into additional premises at Elmdon, Birmingham, and Aberdare, South Wales.

* * *

W/C. H. G. Cattell, D.F.C., who is well known in the aircraft industry and who was until recently sales manager of Aerocontacts, Ltd., has been appointed general sales manager of G. H. Burgess and Co., Ltd., Southall, Middlesex. It is the intention to expand the aeronautical business of this company, who have to date been mainly concerned with work for the M.o.S. and production of towed targets for various air forces.

* * *

Mr. D. R. Samson, B.Sc. (Eng.), A.F.R.Ae.S., previously a member of the senior technical staff in the stress department of de Havilland Aircraft Co., Ltd., has been appointed chief stressman to Hunting Percival Aircraft Ltd.

* * *

Mr. David Ince, D.F.C., B.Sc., until recently technical administration superintendent and base manager for Hunting-Clan Air Transport, Ltd., at Bovingdon Airport, has joined Elliot Brothers (London), Ltd., for technical liaison duties. An ex-war fighter/bomber pilot, David Ince graduated in 1945 from the Empire Test Pilots' School. A keen glider pilot, he holds the International Gold C with one Diamond, and was reserve pilot for the British Team in the 1952 World Championships in Spain.

MR. "JOE" WRIGHT, O.B.E., F.R.Ae.S., of the Dunlop Rim and Wheel Co., Ltd., has been appointed a director of the Dunlop Rubber Co., Ltd.

MR. PETER BLANDFORD, B.A. (Cantab. Hons.) B.Eng. (Sheff.) A.F.R.Ae.S., becomes Vickers-Armstrongs assistant service manager at Weybridge.

MR. DAVID INCE, D.F.C., B.Sc., until recently with Hunting-Clan Air Transport, has joined Elliot Brothers (London), Ltd., for technical liaison duties.

MR. J. G. RENTON, appointed sales manager of Helliwells, Ltd., of Walsall, who have a considerable office and works extension programme in hand.

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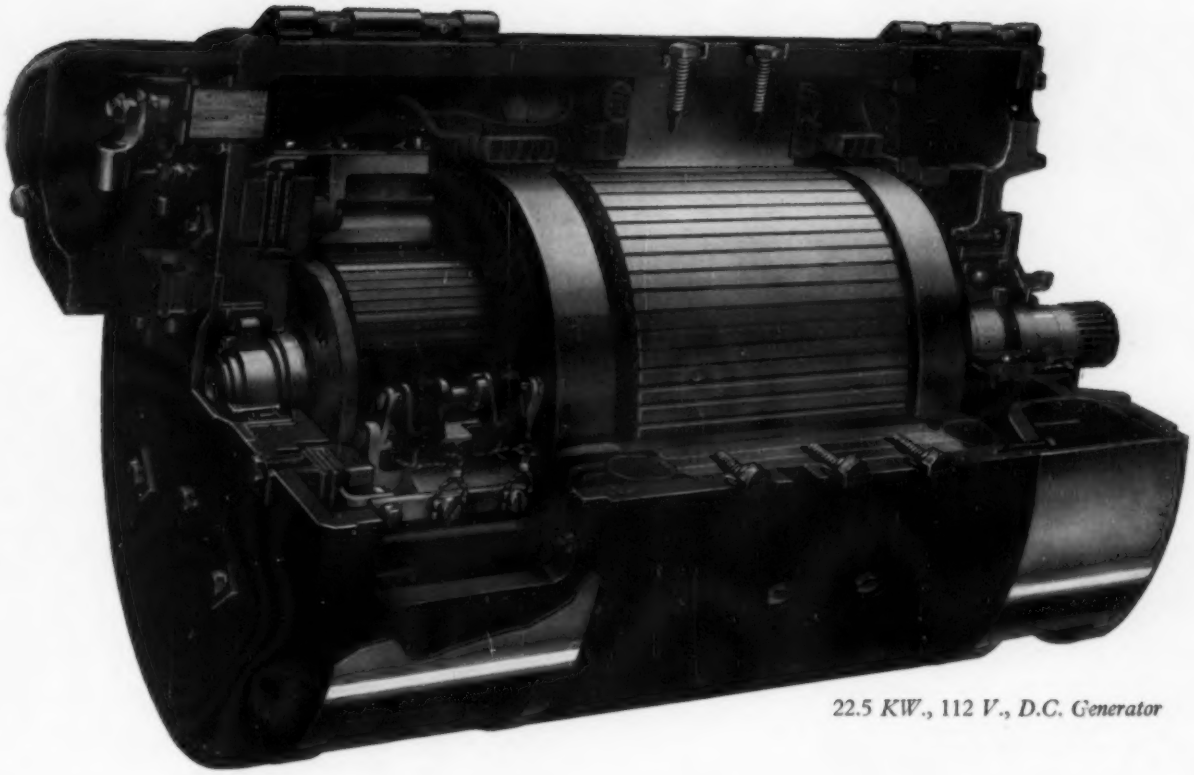

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CIVIL AVIATION

On Going Forward Backwards

JUST over a week ago I would have hesitated to write about rearward-facing seats, on the assumption that most people are thoroughly familiar with all the arguments for and against. On July 10th I heard a talk on the subject by G/C. A. C. Dudgeon, D.F.C., of Transport Command. It was an informative, persuasive and entertaining talk, and it put the advantages of the aft-facing seat into very clear perspective—no wild claims, no concentration on one aspect of survival to the exclusion of all others. Subsequently a very lively discussion developed and someone called for a show of hands. I was surprised to see that four-fifths of a reasonably well-informed audience (consisting of members and guests of Aviation Forum*) were in favour of the rearward-facing seat for all civil transport aircraft. This was not just a tribute to the persuasion of the speaker; in many cases —my own included—the group captain was preaching to the converted.

Subsequent further researches convinced me that there is a wide body of expert medical and technical opinion in favour of the aft-facing seat. I was also forced to the conclusion that both operators and licensing authorities have tended to side-step the issue, and will continue to do so unless it is kept warm. As a passenger, I do not consider myself qualified to *demand* rearward-facing seats. But I think it fair to ask that the subject be considered in the same terms of rational thought applied to most other aspects of air transport—performance requirements, for example.

Of aft-facing seats the present chief technical officer of the Air Registration Board once wrote, very wisely: ". . . the more one studies the matter the more one feels the answer is not a choice between black and white, but rather between various shades of grey. Perhaps this is true of most problems once they are approached from a scientific rather than an emotional point of view." Precisely. To distinguish between subtle shades of grey, incredible numbers of man-hours have been spent on the various aspects of airworthiness and aircraft performance—often minute in themselves but each an integral part of an overall standard of reliability. The result of this work is seen in the safety record of the scheduled airlines.

But there remains—and so far as one can see will remain—the risk of accident to any given flight operation. This risk is accepted, and so too is the need to minimize the effects of accidents when they occur. It is not pessimism or lack of confidence which has led to the formulation of "crashworthiness" requirements, but a realistic desire to protect passengers and crew throughout every phase of every flight operation—including the odd one in 10,000 which ends with a mishap of some sort.

The aft-facing seat question represents one small facet of the whole complex pattern of crashworthiness. As such it is entitled to its fair share, and no more, of rational consideration. The point which I hope to make is that emotional rather than rational thought has been predominant in this particular case. The whole thing is still on a black-and-white basis.

Let us consider, briefly, the history of the rearward-facing seat, the advantages put forward for it and such counter-arguments as its opponents have produced.

It is not certain when rearward-facing seats were first thought of as a method of increasing passengers' chances of survival in an accident. However, G/C. Dudgeon has referred to a paper on the subject written as early as 1942 by a F/L. Pekarek at Farnborough. Both these officers were closely concerned with the introduction in 1946 of aft-facing seats, as a semi-experimental measure, in aircraft of No. 46 Group, Transport Command. Within the R.A.F. there were mixed feelings about the value of the idea, and, no doubt, a great deal of strife at staff levels. Suffice to say on this occasion that all Transport Command's large aircraft, present and future, have or will have rearward-facing seats. Furthermore, some progress is being made in reversing the seats fitted to smaller passenger-type aircraft.

During 46 Group's trial period some 10,000 passengers were asked to fill in questionnaires asking their opinion of rearward-facing seats. It is important to note that this questionnaire made no mention of the safety aspect, and in fact only one passenger (an Army major) said, in effect: "I prefer it this way because it's safer." The results of the survey were: 65 per cent preferred to face aft; 30 per cent had no preference (the majority because they had not flown before); 3 per cent—practically all experienced aircrew—disliked the idea intensely; and 2 per cent ignored the questionnaire.

Another survey along these lines, differing mainly in that passengers were notified of the reason for fitting aft-facing seats, was conducted a couple of years later by the Air Transport Command of the U.S.A.F. Altogether 1,020 people were involved, of whom 94 per cent replied "Yes" to the question: "Considering safety advantages, do you favour this arrangement?"

The number of civil operators who have followed the R.A.F.'s lead in adopting aft-facing seats is very small. Included in this minority are some of the British independent operators, including Airwork, Air Charter and Eagle. In addition, some manufacturers are making full provision for the fitting of aft-facing seats as standard equipment on projected new transport aircraft—e.g., the Atlantic, Friendship, H.P.R.3 and Twin Pioneer.

The U.S.A.F., so far as I know, has not equipped its present aircraft with aft-facing seats, but it was decided in 1953 that future aircraft should be so provided. The first of these is the Convair C-131A Samaritan, an ambulance version of the familiar Convair 240.

No requirement or recommendation for the fitting of aft-facing seats on present or future aircraft has been written into the international standards laid down by I.C.A.O. To my knowledge, the only airworthiness authority to have issued any definite pronouncement along these lines is our own A.R.B. Current British Civil Airworthiness Requirements contain the following non-mandatory clause: *"To avoid as far as possible the risk of injury to the occupants under emergency and minor crash conditions it is recommended that, where practicable, seats should be aft-facing."*

In 1952 the Australian Department of Civil Aviation came out with a proposal to issue a firm requirement for the fitting of 12g rearward-facing seats in all future transport aircraft. Shortly afterwards the Australian Minister for Civil Aviation announced that the proposal had been dropped—presumably as a result of pressure from the airlines.

The reasons for the proposal were set out in a paper, dated July 1952, by Mr. R. R. Shaw, the Department's supervising aeronautical engineer. His introductory notes included this passage: "The whole question is one of degree, and of compromise. The only way to stop all fatalities is to stop all flying. It would be quite possible from the engineering point of view to design aircraft in such a way that the crash fatality rate would go down by 95 per cent. But this would mean carrying, say, only five passengers in an aircraft the size of the DC-4. Such steps as these are economically untenable. But leaving aside the absurd extremes, it is believed that it can be shown that a substantial improvement in the survival-rate can be achieved in aircraft of current design by steps which involve a relatively small economic penalty. It is felt that there is a strong moral obligation to take these steps."

The question to be answered, in rational terms, is: "Does such an obligation exist?" If it does, it has clearly been shirked.

The advantages claimed for the aft-facing seat can be summed up very simply. A large majority of casualties in aircraft accidents result from the deceleration produced by impact with the ground, varying from, say, 1g in a smooth belly-landing and 20-40g in more severe crashes leaving the fuselage wholly or partly intact. Properly supported, the human frame can withstand the highest deceleration likely to be encountered in any crash which is basically "survivable"—one in which complete crushing, burning or disintegration of the fuselage does not occur. Protagonists of the backward-facing seat maintain that this is the best method of providing such protection because (a) it places a shield between the body and the most likely sources of injury and (b) because the back of the human body is stronger than the front. Expressed in its simplest terms, the argument for the aft-facing seat is that in any given set of circumstances it is safer than the forward-facing seat.

Evidence to support this theory is convincing but by no means conclusive from a technical viewpoint. Indeed, as no two accidents can be identical in their nature, it is difficult to see how conclusive proof could ever be obtained. Essential details of the major accidents to aircraft equipped with backward-facing seats are as follows:

On December 20th, 1950, an R.A.F. Hastings crashed at Benina after an airscrew blade had torn into the fuselage, severely injuring one of the crew and jamming the elevator and rudder controls. While attempting to land on two engines it undershot and crashed heavily. All five members of the crew were killed (a point which indicates the severity of the impact without necessarily affecting the seating controversy), but the 26 passengers, who, with one exception, were in 15g rearward-facing seats, escaped without serious injury. On February 18th, 1951, an R.A.F. Valetta crashed into a wooded hill near Stockholm during a single-engined overshoot in bad visibility. One of the crew of three was killed and

* *A discussion group whose primary interest is "the furtherance of air transport."*

HERMES IVA troopers operated by Airwork are fitted with aft-facing seats. One of the company's pilots, Capt. C. D. Stenner, reports in the "Handley Page Bulletin" that "Many of our passengers are travelling by air for the first time and do not think it unusual to face backwards. There is certainly no unfavourable reaction to seats which face aft."

CIVIL AVIATION . . .

all 18 passengers, in 20g rearward-facing seats, escaped with minor injuries. Another Valetta crashed near Boscombe Down on November 25th, 1952, after being in collision with a Venom. The nine passengers (paratroops) stepped out of their rearward-facing seats unhurt, and the crew of four all received injuries. In a third Valetta accident, at Lyneham, on January 20th this year, one of the crew of five was killed and four injured; the six passengers, all in aft-facing seats, received only very slight injuries.

Both theory and practice, then, show that there is a strong case for fitting rearward-facing seats in transport aircraft. What are the arguments against such a step? Objections have been raised, mainly by airline operators, under two main headings.

What of passenger reaction? "The passenger wouldn't like it" is by far the most popular argument. Undoubtedly this would be true of a proportion of passengers, although the surveys mentioned earlier suggest that the proportion might not be large. It is worth remembering, too, that R.A.F. transport aircraft have tailwheel undercarriages, and aft-facing passengers tend to slip off the seat during the first part of the take-off run. Even this small element of discomfort would be absent in the vast majority of modern airliners. Presumably objections to facing aft in flight would be based on the argument that it is unnatural not to face the direction of travel. Perhaps it is. But flying is still regarded by the majority of airline passengers as an "unnatural" mode of travel anyway. Nothing but a 100 per cent survival record will change this outlook.

Finally we come to the fatuous argument that aft-facing seats are psychologically bad, because they suggest the possibility of an accident. One might carry this argument further and advocate the abolition of lifejackets and instructions on how to wear them.

Somebody, I feel sure, is going to point out that some aircraft now in airline service carry equal numbers of rearward- and forward-facing seats, and that most passengers choose the latter. Even if this is true, it does not affect the basic issue at stake. As it happens, choice of seating is influenced by the fact that forward-facing seats in the aircraft concerned occupy the after part of the cabin, which is usually (a) quieter and (b) more crashworthy.

As to cost, it would undoubtedly be an expensive and inconvenient process to uproot all current seating arrangements. However, the cost penalties have been greatly exaggerated. At present, floors, anchorages and seats in civil airliners are stressed for 6 to 12g. All arguments put forward for the *ideal* rearward-facing seat have assumed an ability to withstand 20 to 25g. Airline operators naturally shrink at the thought of a costly, wholesale switch from existing forward-facing seats to much stronger aft-facing seats. But such a drastic step is not immediately advocated.

Acceptance of the principle of rearward-facing seats, coupled with a progressive stepping-up of stress factors, promises to offer a real improvement in crashworthiness. Can the airlines prove otherwise?

Regardless of whether a decision is reached on this matter, aircraft of the near future are certain to have stronger floors and stronger seats. Airworthiness authorities are now talking in terms of 15 to 25g. Aft-facing seats may then be essential if full advantage is to be taken of this additional strength, in order to avoid the danger of head injuries from closely pitched seats. The passenger's chances of escaping uninjured from a 20g impact, using a 20g forward-facing seat and simple lap-strap, seem very doubtful—whereas there is little doubt about the efficiency of a rearward-facing seat under these circumstances. In fact, the existing type of lap-strap may have to be replaced by a full Sutton harness and head-band if forward-facing seats are retained—one more point in favour of facing the other way. R. B.

AMERICAN VISCOUNTS

THE appearance of an American report listing some of the "hundred modifications" to the Viscounts for Capital Airlines is considered by Vickers Armstrongs to be misleading. Many of the so-called modifications, they point out, are merely choices "off the shelf" from a large number of fully developed alternatives while others are features which have always been standard on every production machine. The following is a brief history of the Americanization of the Viscount, since the first order for 15 Viscount 724s for Trans-Canada Airlines was placed in the autumn of 1952.

The order for the 15 Canadian machines was a sufficiently large one to justify the development of a Viscount specifically tailored to the needs of North American operators. To this end, thousands of hours of drawing-office time have been expended in such items as the following:—

(1) Conversion of the whole aircraft to accept some American flight instrumentation and radio.

(2) Redesign of the cockpit in detail to conform to transatlantic practice.

(3) A general re-engineering of the entire machine to North American standards (neither better nor worse than our own) and conditions, in such items as threads, wiring, pipe connectors, and so forth, together with some production of drawings to third-angle projection.

This done, work proceeded on developing certain items requested by T.C.A. These included:—

(1) Provision of a third wiper on the centre cockpit window, for use during cross-wind landings in bad weather. Contrary to the American report, T.C.A. did not call for "bigger windshields."

(2) A redesign of the water system to incorporate a purifier. This was done owing to a reported mistrust by the airline of the potable quality of some Canadian water.

(3) A redesign of the cabin-air system, with AiResearch pressure controllers and Janitrol heaters.

(4) Deletion of the autopilot (Smiths S.E.P.2) but with provision for the equipment to be installed if required.

(5) Installation of NESA electrically heated cockpit windows.

All these modifications having been carried out, it has proved a relatively simple task to develop Viscounts to the requirements of Capital Airlines. At present three, with the type number 744, are being made for delivery to Capital early next year, this early delivery having been made possible by the fact that the aircraft take the place of three originally earmarked for B.E.A. Equipment specified by Capital (and generally available "off the shelf") includes:—

(1) Provision of fixed crew-oxygen, this being standard Capital equipment.

(2) Installation of the airline's own standard public-address system.

(3) Use of the "Americanized" cabin-air system, without the Janitrol heaters.

(4) As the radio is remotely controlled, the window normally provided for the radio officer is to be deleted.

(5) In place of the cockpit synchroscopes, which tell the pilot whether or not all four Rolls-Royce Darts are in phase, the full Rotol automatic engine synchronization system will be installed.

(6) Following competitive trials with other autopilots, Capital have placed a firm order for British Smiths S.E.P.2 equipment in their Viscounts.

(7) Contrary to T.C.A. practice, the Viscount 744s will revert to standard B.E.A. windscreen de-icing by hot air and alcohol.

The report published in an American journal, referred to above, appears to list "specified" features rather than modifications; for example, brakes for the retracted nosewheels and seat-mounting tracks have been fitted to every production Viscount. Some of the specified equipment is, however, worth quoting, and includes such items as Rotol rebated-blade airscrews, winterized door-seals of neoprene rubber, a Perspex blister to protect the landing-gear visual indicators (which project upwards above the inner wings) and a form of fuselage soundproofing slightly different from that normally fitted. It is also worth noting that, perhaps owing to a reported dislike on the part of T.C.A. to knobs and catches which can be reached by passengers, the number of windows fitted as inward-pulling emergency exits is reduced to six (the legal minimum) in the American machines. In B.E.A. Viscounts all but four of the 20 windows can be used as exits.

Vickers, we learn, are concerned to note that the American journal has stated that "Viscounts also have lost baggage doors on the lower right side . . . Several have been lost in flight by

British European Airways." In fact, as has been reported by *Flight*, there has been but one "incident"; in this case, two locking pins, not properly secured, allowed the door to deflect under pressurization loading so that, eventually, one edge of the door came away from its seating so permitting some loss of air. To our knowledge—and to the manufacturers'—no B.E.A. door has ever come off, or even opened, in flight.

The final point under discussion is the omnipresent question of fatigue. The chief of the C.A.A.'s Aircraft Engineering division, Mr. W. H. Weeks, is quoted as saying "Problem is that the Viscount has a single wing spar." We do not believe any company can be dogmatic about fatigue problems today, but it seems to be a fair opinion among international airline operators—who can be relied upon to know the world's aircraft manufacturers very well—that Vickers have conducted more extensive fatigue-testing and have a more thorough knowledge of the subject, than any other company. Vickers themselves point out that no one can yet claim to be able to design a structure which will never show fatigue; they do, however, claim to be able to design an airframe which will *never fail catastrophically* from this cause.

There is some difference in fundamental thinking on the basic design of structures in this country and America; but it appears to us that Vickers Armstrongs have many precepts which will be widely accepted elsewhere in the years to come.

THE COMET INVESTIGATION

IT was unofficially stated last week-end that "pressure-fatigue" tests with a Comet fuselage at Farnborough had yielded results explaining the cause of the three Comet disasters. These reports were not confirmed by the Ministry of Supply, which, pending the official inquiry, is mantaining a policy of near-silence on the subject of the current investigations at Farnborough.

The most recent official reference to the investigations was that made on July 5th by Mr. Duncan Sandys, Minister of Supply, when he said that the R.A.E. technical examination was making good progress. Mr. Sandys laid stress on three lines of inquiry: metal-fatigue of wings, tail and main structure; "exhaustive testing" of the strength of the pressurized cabin; and the possibility of excessive pressure in the wing tanks resulting from the use of high-pressure fuel pumps. He added that these and other tests were still proceeding, and that it would be premature to announce the results obtained.

The public inquiry into the Comet accidents is to be held by the end of October at the latest. It is unlikely that the full story of the investigations will be told until the inquiry is held. Meanwhile, it seems best to treat unofficial disclosures with a grain, if not a pinch, of salt. Our own impression is that the possible causes have been narrowed down and the investigation to date gives real grounds for optimism, but that efforts to pin-point the precise cause or causes of the accidents have in no way relaxed. This may not be "news" in the widely accepted sense, but it probably comes nearer to the truth than the more sensational newspaper reports.

CONFIDENCE: After flying with John Cunningham in a Comet 2 during a recent test flight, Dr. Paulo Sampaio (left), president of Panair de Brasil, remarked: "My confidence in these aircraft has never wavered." Panair have ordered Comet 2s for their South Atlantic services.

QUICK OFF THE MARCK

BY the end of this year it is expected that Calais Chamber of Commerce will have spent nearly £150,000 on their new airport at Marck, which was provided specifically for the car-ferry services of Silver City Airways. It was built with almost incredible speed: forty-two days after work began the airport was ready for use. On June 1st, the first day of operation as a cross-Channel terminal, Marck handled 100 movements by Bristol 170s. The two runways are of compacted earth but will be completed in concrete in October. The main runway (NE-SW) is 3,600ft long, and the other (NW-SE) is of 2,950ft. Concrete taxiways and a marshalling apron will also be provided. Terminal buildings include a spacious restaurant. Silver City's new airport at Ferryfield, which came into operation at 8 a.m. on Tuesday last, handles all Le Touquet flights, but Lympne remains the base for services to and from Calais.

CLEANED-UP CONNIES

ACCORDING to *Aviation Week*, Lockheed 1049 Super Constellations will gain approximately 12 m.p.h. under long range cruising conditions at 20,000ft as a result of modifications requested by T.W.A. Details of the modifications are as follows: extension of engine nacelles; elongation of wing-fuselage fillets; rearward extension of spinners and improvements to the shape of the cowlings; closing of one of the three wing intakes for cabin cooling air and reduction in size of a second intake; removal of "wing walkway paint."

BREVITIES

THE Tanganyika Government announces that the opening of the new Dar es Salaam Airport will take place on October 16th.

* * *

Qantas and K.L.M. have concluded an agreement whereby the Dutch company's overhaul and servicing in the Far East will be handled by the new Qantas workshops at Lae, Australian New Guinea.

* * *

Propellers Approved for Use on Civil Aircraft is the title of a list isssed by the A.R.B. in the form of a Notice to Licensed Aircraft Engineers and to Owners of Civil Aircraft (No. 4, issue 15).

* * *

Mr. W. T. Denyer, publicity controller of Central African Airways, has recently been on a short visit to the U.K. His departure for Salisbury last week on his company's Zambesi service was marked by a "sundowner" at Rhodesia House, London.

* * *

Official approval has been granted for an overhaul life of 1,000 hr kor Gipsy Queen 70-3 and 70-4 engines installed in de Havilland Doves. The extension from 800 hr follows satisfactory test runs of 1,000 hr and a build-up of experience amounting to some 360,000 engine-hours annually. Plans are in hand for a similar extension for the Gipsy Queen 30-2 (the Heron's power unit), and there is sufficient experience with this engine to permit 1,000 hr trials.

* * *

On Sunday next, July 18th the Hermes will return to service with B.O.A.C.—a result of the present grounding of Series 1 Comets. Three of the four weekly tourist return flights between London and Nairobi will be operated by 56-seat Hermes instead of Argonauts until the first week of August, when the Hermes will take over completely on this route. From the end of July, tourist Argonauts operating weekly services between London and Dar es Salaam will also be replaced by Hermes.

* * *

According to a Johannesburg correspondent, South African Airways are likely to buy Super Constellations for their international routes, adding that the company had previously intended to buy three Comet 2s. This report has been denied, however, by a S.A.A. spokesman, who said that while the purchase of Comets was out of the question, pending the result of the present investigations, no final decision on re-equipment had yet been taken.

* * *

The United Kingdom staff of T.W.A. is to be increased by 25 to a total of 87; the additional personnel will be engaged in loading, cleaning and apron-servicing T.W.A. aircraft calling at L.A.P. Previously this work was performed under a ground handling agreement with B.O.A.C.

Announcing that this agreement will be discontinued from November 1st, T.W.A. explain that since the airline is now handling 30 transatlantic arrivals and departures weekly (compared with 12 when operations started in 1950) the new organization will prove more economical and no less efficient.

CIVIL FORMATION: The two Austers (pilots, A. Noyes and R. Wallis) had a rough ride while formating on three Magisters (pilots, W. H. Bailey, D. F. Ogilvy, C. Nepean Bishop) in the bumpy weather prevailing for the Elstree Flying Club's At Home on June 12th.

CLUB AND GLIDING NEWS

EACH successive year M. André's Royal Aero Club Deauville Rally sets a new attendance record—or perhaps it should be described as a new hospitality record. This time there were slightly fewer light aircraft on the airfield at St. Gatien, but well over 300 guests arrived—one official party in an Eagle Viking.

As in most other places in Europe, the week-end of July 3rd-4th was stormy at Deauville, but spirits were neither damped nor diluted.

The Saturday's gala dinner filled the luxurious Ambassadeur's Casino ballroom to capacity. Informal speeches were made during the presentation of prizes (these awards included the sealed time-of-arrival prize, which went to Mr. John Houlder in his Gipsy Gemini). Lord Brabazon pleased everyone with his humour both on Saturday and Sunday evening. On the second occasion, after the announcement of a French win—by five matches to one—of the Golf Challenge Cup, he asked "Must airmen make airshots?"

Thanks were also expressed to M. André and the Deauville authorities by Col. Philip Livry Level, D.S.O., D.F.C., C. de G., chairman of the Deauville Flying Club. (Few people, perhaps, knew of his remarkable war-time record of 161 operations in Mosquitoes, Halifaxes and, on "clandestine work," in Hudsons.)

On the Sunday, before the golf match, some 140 of the guests took lunch at the beautiful Hotel du Golf situated on the hill behind Deauville and Trouville. The first item on the menu, named *Le Mystère IV*, proved to be a tasty "banger" roll with swept wings and tail.

A number of the visiting aircraft reluctantly returned to England on the Monday morning and, as on the way out, profited by a tail-wind and some sunshine between showers. Other crews went on to holiday in the south or set a leisurely course for La Baule, where M. André's second annual R.Ae.C. rally took place last week-end.

A BURST OF SUNSHINE brightened St. Gatien airport for the photograph below of aircraft in the Deauville Rally. "Flight's" Gemini shares the foreground with a Proctor, Fairchild and French-registered Gemini I. Seen above, at the gala ball, are Colonel and Mrs. R. L. Preston (left) and Mr. Ranald Porteous partnered by Mrs. Peter Hillwood; Mr. Beric Lamplugh and partner may be seen behind them.

WELL-KNOWN in light-aircraft and gliding circles, Mr. J. C. Rice, of Cosby, Leicestershire, lost his life in a flying accident in Switzerland on July 2nd. He and his wife, who was also killed, were attending the international "Swiss watch" air rally at Bienne, about which he had written to us only last month. Mr. Rice was the owner of Miles Whitney Straight G-AEVA; it is reported that the machine flew into a mountain near Moutier.

Jack Rice took up gliding in 1937, and obtained his "A" licence for powered aircraft the following year. A caravan manufacturer by trade, he designed and built the majority of covered-glider trailers used by clubs and private owners in this country, and was always very generous to the gliding community. During the war he was in charge of an A.T.C. Gliding School, and later served on the Council of the B.G.A. Since 1949 he had attended most of the international flying rallies, many in his Whitney Straight. His wife accompanied him on all his touring flights, and the couple were well known and affectionately regarded by the pilots of many Continental flying clubs. He was 62 years of age. A memorial service to Mr. Rice will be held at Cosby Church, near Leicester, tomorrow (Saturday), July 17th, at 12.30 p.m.

THE Royal Aero Club handicappers have announced the basic figures which are to be used in the handicap formulæ for the more popular aircraft types taking part in the National Air Touring Competition at Cranfield on Saturday, August 14th. They are: Tiger Moth, speed 87 m.p.h., hourly fuel consumption 5.28 gall; Taylorcraft, 89 m.p.h., 3.6 gall; Moth Minor, 91.5 m.p.h., 3.6 gall; Auster Autocrat, 93.5 m.p.h., 4 gall; Auster 5, 95 m.p.h., 5.2 gall; Hornet Moth, 96 m.p.h., 5.28 gall; Auster Autocar, 101 m.p.h., 5.28 gall; Messenger 4, 101 m.p.h., 6.6 gall; Miles Hawk, 104 m.p.h., 5.28 gall (Gipsy Major 1), 106.5 m.p.h. 5.68 gall (Gipsy Major 1C); Chipmunk, 116 m.p.h., 5.8 gall; Gemini Ia, 117 m.p.h., 8 gall; Proctor 1 and 3, 122.5 m.p.h., 8.32 gall. These are "standard" figures for the types, to be related to the actual performance of the aircraft in determining the scoring for the competition.

The competition is divided into two classes, for private and club entries respectively. The Grosvenor Challenge Cup will be awarded to the highest-placed private entry, and the Siddeley Challenge Trophy to the highest-placed club entry.

SINCE the article on the World Gliding Championships on pages 73-74 went to press, news has been received that the Dutch KNVvL 491 will not take part. It will not be ready in time owing to the necessity for a number of modifications. Otto Koch will now fly an Olympia (built by Fokker) which has been chosen to replace the 491 following comparative tests with a Minimoa. Other news of the championships, announced recently by Philip Wills, is that the British team is to use a new long-range thermal-detector, designed by Peter Temple and working on the thermocouple principle.

R.Ae.C. PILOTS' CERTIFICATES, MAY-JUNE

No.	Name	Cl.	Date	No.	Name	Cl.	Date
28,594	J. G. R. Read ...	4	3/5/54	28,603	F. Morrell ...	2	4/6/54
28,595	L. Patrick ...	3	6/5/54	28,604	W. B. Kentfield	3	4/6/54
28,596	W. R. Luxton ...	4	12/5/54	28,605	T. S. Blyth ...	1	9/6/54
28,597	J. A. Pickles ...	4	14/5/54	28,606	S. Streets ...	4	11/6/54
28,598	G. M. Stowell ...	4	19/5/54	28,607	G. Fowkes ...	1	11/6/54
28,599	G. S. Hunter ...	2	26/5/54	28,608	P. Blamire ...	1	11/6/54
28,600	R. E. W. Smerdon	1	26/5/54	28,609	J. H. Whatling	2	23/6/54
28,601	A. H. Pybus ...	4	2/6/54	28,610	R. M. Moon ...	3	23/6/54
28,602	E. W. Kenny ...	2	2/6/54	28,611	D. R. Webb ...	3	23/6/54

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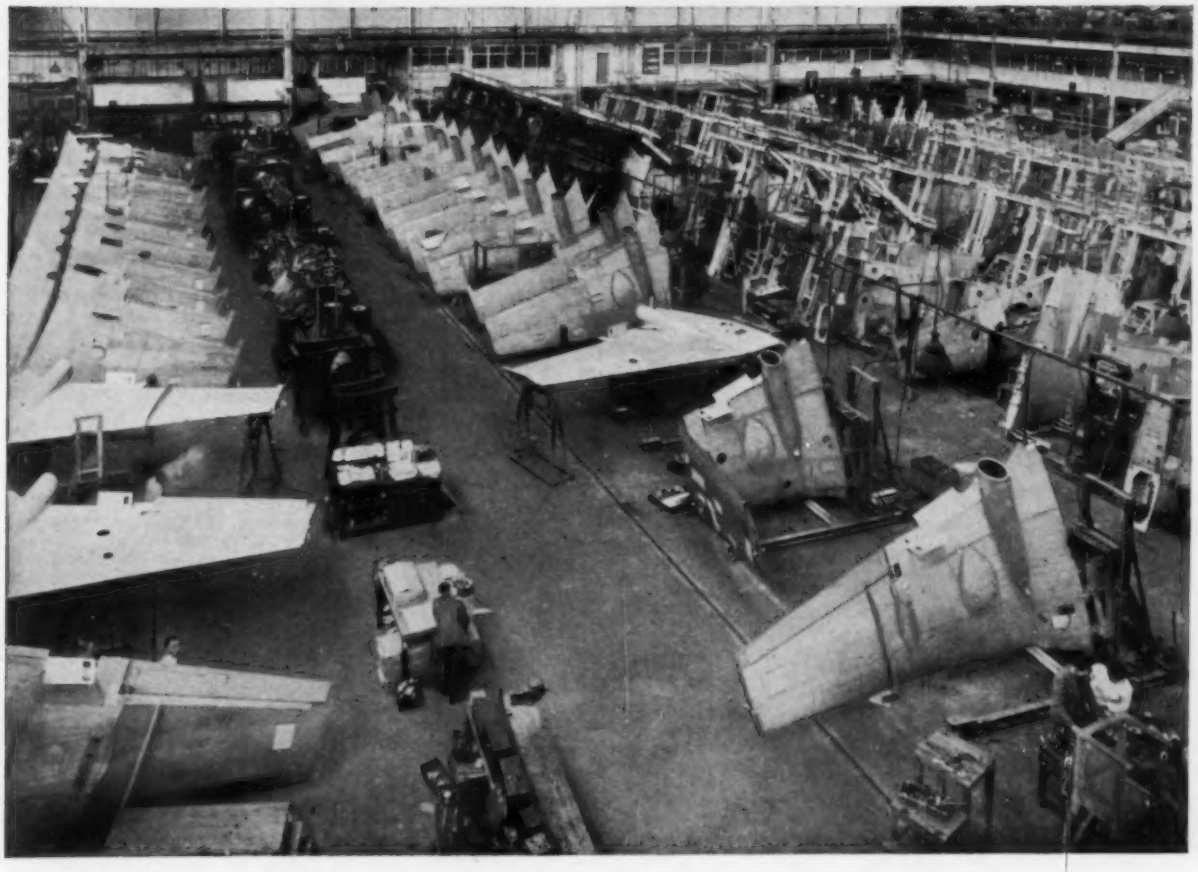

The Folland factory is laid out for p·r·o·d·u·c·t·i·o·n. An idea of its output potential can be gleaned from the above photograph of part of the wing assembly shop.

This is one of a series of announcements depicting the productive resources of

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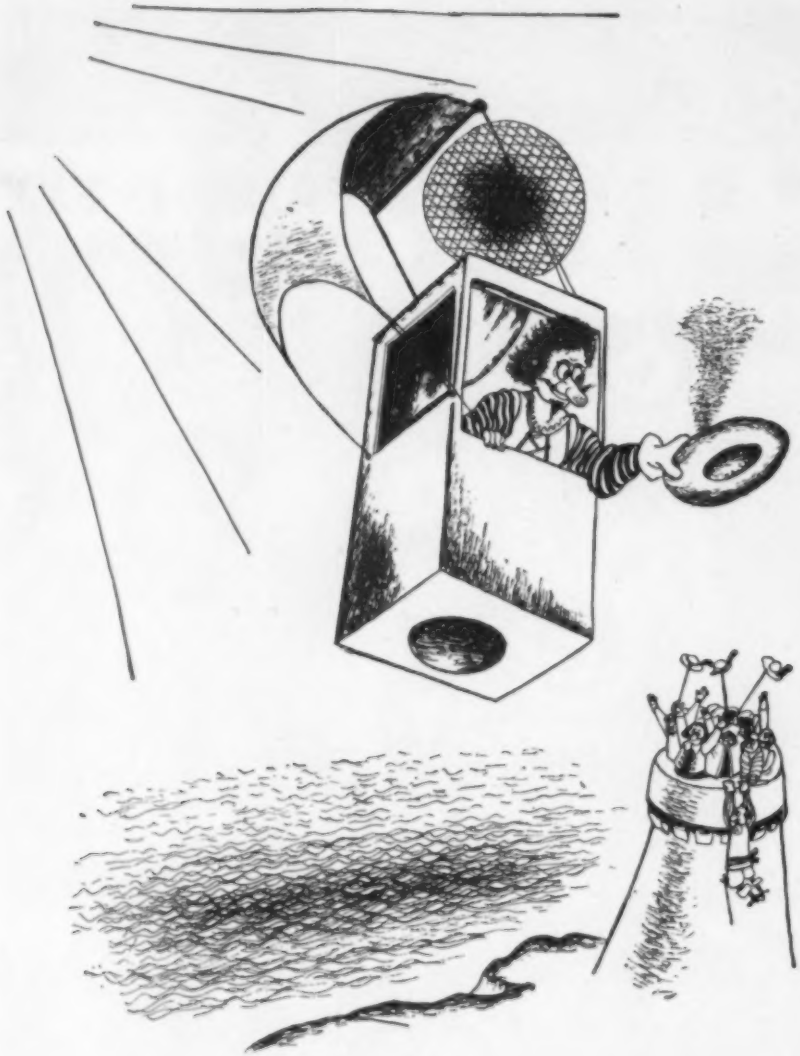

A page from
THE ESSO HISTOIRE OF AERIAL LOCOMOTION
Adapted from the French de P. Crochet-Damais. Illustrated par Philippe Féty avec permission.

CYRANO DE BERGERAC, ASTRONAUT

HERCULE-SAVINIEN DE CYRANO DE BERGERAC, star pupil of Gassendi, was one of the most brilliant and crack-brained inventors of all time. In his " Histoire Comique des Etats et Empires de la Lune " he devised a thousand contraptions to combat the force of gravity and to help man achieve the power of flight.

His ideas roared through the universe: he toyed with the heat of the sun, the realms of outer space and with the influence of the moon on such substances as beef marrow. Eggs fascinated him, for he believed that he might rediscover the formula for making egg-shells airborne. (The idea was to fill the shells with dew and to allow this fuel to be evaporated by the heat of the sun — as simple as that.)

Easily his most successful invention, however, was his wooden flying machine. It was six feet high and three feet wide and had a hole in the base and a twenty-sided crystal globe mounted above it. The machine was powered by magnetism derived from the sun's rays and by air currents generated by " l'horreur du vide."

We do not know what distance C. de B. covered in his flying cubicle, but Montgolfier and other pioneers of balloon-flight always regarded him as their progenitor and inspiration.

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SERVICE AVIATION

Royal Air Force and Fleet Air Arm News

"AIRCENT" VISITOR: The Duke of Edinburgh being introduced by Air Chief Marshal Sir Basil Embry to officers of Allied Air Forces Central Europe at Fontainebleau during his recent tour of NATO Commands.

R.A.F. Appointment

THE Air Ministry has announced the appointment of A.V-M. W. M. L. MacDonald, C.B.E., D.F.C., as Assistant Chief of the Air Staff (Intelligence) as from September next. In order to take up his new post A.V-M. MacDonald will return from the Far East where, since June 1952, he has been A.O.C. Singapore.

During the war he served mainly with units of Bomber Command, going in the first place to France with No. 150 Squadron, which formed part of the Advanced Air Striking Force. For two years after the war he was Commandant of the Central Flying School at Little Rissington.

Polar Navigation Flights

TWO Hastings of the Royal Flying College, Manby, left last week-end for a series of high-latitude navigation flights from Bodö in Norway. Both aircraft flew over the geographical North Pole. The team, consisting of ten aircrew and eight ground crew, led by the College's commandant, A. Cdre. G. A. Walker, C.B.E., D.S.O., D.F.C., A.D.C., left Manby at 1100 hr on Friday and returned at 1830 hr on Monday. On the outward journey both aircraft reached Bodö in five hours.

Two graduates and two staff members of the R.A.F. Flying College acted as captains and co-pilots in the two Hastings —W/C. S. B. Grant, D.F.C. (syndicate leader) with the commandant as second pilot, and W/C. A. H. Humphrey, O.B.E., D.F.C., A.F.C. (senior instructor) with W/C. M. D. Iyne, A.F.C., as second pilot. Their navigators were, respectively, F/L. F. R. Wood and S. L. D. Bower, M.B.E., the senior navigation instructor at the College. Earlier this year W/C. Humphrey and S/L. Bower flew the Flying College's B.2 Canberra *Aries IV* on the record out-and-home flights from South Africa.

A passenger in one of the aircraft was Mr. Frank Beswick, M.P., and the Senior Norwegian forecaster at Bodö, Mr. Sverre Hoppestad, flew on one of the two flights planned for each aircraft. The student specialist navigators, members of No. 5 course, were S/L. D. Clare, D.F.C.; S/L. M. C. Bunting, M.B.E.; S/L. G. Sproates (1st aircraft); and Lt. Col. C. A. North, U.S.A.F.; S/L. J. E. Tipton, D.F.C.; and S/L. H. E. White, D.F.C., A.F.C. (2nd aircraft).

Guest Night Extraordinary

AT a recent guest night No. 18 Squadron were able to entertain no fewer than ten previous commanding officers, including G/C. G. I. Carmichael, D.S.O., A.F.C., who had the squadron when it was first formed at Northolt in 1915. It was then equipped with Vickers "Gun Bus" fighters and now has Canberra B.2s.

Following a brief speech of welcome by S/L. R. A. Cooper, M.B.E., the present C.O., G/C. Carmichael, described conditions in the squadron as they were in the early days, when each unit trained its own mechanics and pilots from the *ab initio* stage: they were sent to France for front-line service with less than six months' training. He told his audience, also, of the origin of the flying horse that figures in the squadron badge: it was chosen because they were detailed to perform contact patrols with the cavalry in the battle of the Somme in 1916.

G/C. Carmichael modestly omitted to mention that his own military flying experience went back as far as 1913, when he and another lieutenant flew to Colchester on an R.F.C. recruiting tour, giving passenger flights to officers of the garrison there. He also failed to add that he flew to France with No. 5 Squadron in August 1914 as part of the original British Expeditionary Force. (We may whisper that he wrecked one aircraft on the way but obtained another and arrived in France the same day.)

Both G/C. Carmichael and A.V-M. Sir Ronald M. Reid, K.C.B., D.S.O., M.C., who commanded No. 18 in 1917, were taken for a flight in the squadron's Canberras. (A photograph of the earlier members of the squadron attending the function appears overleaf.)

Para-rescue Badge

A NEW badge to be worn by qualified R.C.A.F. para-rescue personnel has been approved. The badge, featuring an open parachute between upswept wings, will be worn by the nursing sisters, medical officers, airmen and N.C.O.s who have completed the rigid para-rescue course held at Edmonton and Jasper, Alberta. Although wings have not previously been awarded, a small badge featuring an open parachute was worn on the working-dress sleeve of para-rescue personnel.

It will mark the first time female officers of any Canadian service have worn a Canadian badge emblematic of aerial operations.

To date, five doctors, seven nursing sisters and 44 airmen have passed the gruelling 18-week course. All are volunteers chosen on a basis of general fitness and mental alertness. Each graduate makes ten jumps before qualifying.

Two Command Appointments

AFTER having been A.O.C. R.A.F. Element, Maritime H.Q. Chatham, A. Cdre. W. H. Hutton, C.B.E., is to become A.O.A. at Coastal Command H.Q. A. Cdre. D. M. T. MacDonald, C.B., who has been Chief Instructor of the Transport Support Wing at the School of Land/Air Warfare, now becomes S.A.S.O. at Transport Command H.Q.

Almost the whole of A. Cdre. Hutton's Service career has been devoted to Coastal Command, for he has served twice—once as C.O.—with No. 210 Squadron. A. Cdre. MacDonald is an armament specialist and was at one time in command of No. 7 Gunnery School.

High Speed to Cyprus

CANBERRAS have become a quite familiar sight in the Mediterranean area: a number of routine service flights, for example, and trials have taken various marks to Malta. Last Monday G/C. S. W. R. Hughes flew a Canberra from England to Cyprus in 3 hr 32 min, an average speed of 650 m.p.h. The flight was described as a routine trial, and the aircraft is normally based at R.A.F. Farnborough.

Canadian Carrier Appointment

NAVAL headquarters in Canada have announced the appointment of Lt-Cdr. V. J. Walgress, R.C.N., as Commander (Air) in H.M.C.S. *Magnificent*. He will assume the acting rank of commander.

He succeeds Cdr. A. H. Abrams, D.S.C., R.N., who has been on loan to the R.C.N. for the past two-and-a-half years.

R.C.A.F. Trans-Pacific Airlift

THE trans-Pacific airlift operation that the R.C.A.F. carried out for almost four years in support of the United Nations effort in Korea has finished. The final round trip to Japan was made by a North Star which left its home base at Dorval, outside Montreal, on May 29th.

Requirement for air transport support of the U.N. operations in Korea has decreased and there has been a lessening of the overall airlift operations over the northern route. In consequence, the

SERVICE AVIATION . . .

U.S.A.F. is reducing its facilities at Shemya Air Force Base, in the Aleutians, which the R.C.A.F. North Stars have been using as a refuelling point. Without the use of Shemya, economic operation of the R.C.A.F. North Stars would not be feasible.

Canadian Pacific Airlines will continue, for the time being at least, to operate its scheduled airlift flights to Korea, under charter to the Canadian government, as part of the Canadian contribution towards the U.N. effort in Korea. Operating with DC-6 aircraft having a longer range than the R.C.A.F. North Stars, C.P.A. can continue to operate over the route without utilizing Shemya as a refuelling point. C.P.A. is now flying three-and-a-half round trips per week on the Korea airlift between Vancouver and Japan.

The R.C.A.F. began its part in the Korea airlift in July 1950. No. 426 Sqn., acting on very short notice, flew out to McChord Air Force Base, outside Tacoma, in the State of Washington. It took with it its ground crew, administrative staff and ground servicing equipment.

The first North Star took off from McChord on the evening of July 27th to begin the operation. The squadron went through a hectic period at first, maintaining a flight-a-day schedule with only six aircraft on strength. The aircraft total was increased shortly afterwards, although the schedule still called for the maximum from personnel and equipment. This was during the early days of the airlift, when the situation in Korea called for a maximum effort to rush urgently needed supplies and equipment to the hard-pressed U.N. forces there.

As requirements eased the schedule was reduced to 15 round trips per month, and for the last year or so stood at eight round trips per month.

For the first year of its airlift operations the squadron was located at McChord Field. It then moved back to its normal home base at Dorval and the cross-Canada portion of flights utilized for domestic R.C.A.F. requirements. The squadron has also carried out many other important commitments. These included scheduled supply runs into the Arctic and the start of a scheduled trans-Atlantic service in support of the R.C.A.F.'s Air Division in Europe.

The Thunderbird Squadron made more than 600 round trips—1,200 Pacific crossings—and uplifted more than 13,000 personnel, including many wounded. It carried approximately 7,000,000 lb of freight and mail. Not a single life and not a single cargo was lost during the four years of operations.

SCOTS COME SOUTH: Two Chipmunks of St. Andrews University Air Squadron in formation over Shropshire, where the unit spent its summer camp at R.A.F. Shawbury.

Helicopter Training Unit

LAST week Mr. George Ward, Under-Secretary for Air, informed the House of Commons that a small Royal Air Force unit would shortly be set up for the training of helicopter pilots. This was in addition to the training of pilots under civil contract.

Half-Yearly Promotions

BELOW is continued (from page 64, July 9th), the list of half-yearly promotions issued by the Air Ministry.

Squadron Leader to Wing Commander: R. L. Smith; H. C. Bailey; D. L. Prichard, D.S.O.; D. W. Triptree, A.F.C.; R. A. Colville; G. C. Banning-Lover, A.F.C.; J. C. Hunter; P. G. Brodie; J. A. Hemingway, D.F.C.; W. Stapleton; R. L. Fuller, A.F.C.; W. G. Brinn, D.F.C., D.F.M.; R. J. Dempsey, D.F.M.; D. I. Pike, M.C.; A. Hindley, A.F.C.; C. J. Mackenzie, D.F.C., A.F.C.; E. James, D.F.C., A.F.C.; G. K. Birch; P. W. G. Burgess; R. G. W. Oakley, D.S.O., D.F.C., D.F.M.; H. Grant, A.F.C.; B. H. Worts; R. A. Simpson; H. J. Rayner, D.F.C., A.F.C.; H. F. Payne, M.V.O., A.F.C.; W. M. Mason, D.S.O., D.F.C; R. Findlater, D.S.O., D.F.C.; A. E. W. Laband; G. Smythe, M.B.E., D.F.M.; E. Baldwin, D.S.O., D.F.C., D.F.M.; B. J. Jennings, A.F.C., D.F.M.; W. D. Smith; R. L. Wade, D.F.C.; M. W. Coombes; J. S. Owen; H. R. Allen, D.F.C.; T. A. Whiting, D.F.C.; C. S. West, D.F.C.; C. S. Vos, D.F.C.; C. F. Ambrose, D.F.C., A.F.C.; D. Crowley-Milling, D.S.O., D.F.C.; J. L. Mitchell, M.V.O., D.F.C., A.F.C.; A. N. Davis, D.S.O., D.F.C.; D. A. Green, D.S.O., D.F.C.; E. Plumtree, O.B.E., D.F.C.; J. F. Davis, D.F.C., A.F.C.; R. E. Glover, D.F.C.; I. B. Butler, D.F.C., A.F.C.; F. L. Dodd, D.S.O., D.F.C., A.F.C.; C. M. Fell; D. L. Norris-Smith; H. B. Martin, D.S.O., D.F.C., A.F.C.; M. H. Le Bas, D.S.O., A.F.C.; F. J. Waters, M.B.E.; C. S. Hawley, M.B.E.; J. A. C. Scoular; J. L. Davey; E. A. Cox; R. J. Marks; G. A. Fricker; N. W. Turner; W. C. Clements; R. J. Robinson, O.B.E.; P. S. Hall, A.F.R.Ae.S.; R. C. Crosbie; C. Pattison; T. A. M. Pritchard; F. J. Mowbray; I. L. S. Chatfield; J. P. Pryer, A.M.I.Mech.E., A.F.R.Ae.S.; A. G. Clennett, M.B.E.; R. F. Sparrow; W. H. Newman; R. C. Fordham, M.B.E., A.F.R.Ae.S.; A. M. Paterson, O.B.E.; R. E. Skelley, O.B.E., B.Sc.; C. K. Street, M.B.E.; W. E. G. Vaughan; R. E. Cooke; A. P. H. Slogrove; E. F. Wisdom; F. E. McDonnell, O.B.E.; K. E. W. Brace; F. A. Buckingham, H. J. Lucie-Smith; H. G. Belcher; E. Graham; R. M. Coad, A.F.C.; C. Dunkerley; A. James, O.B.E.; H. Bamforth, M.B.E.; R. H. Harris; F. D. Holmes; S. P. Austin; A. E. Anderson; R. B. Evans; H. A. Lax; E. L. Frith; T. A. Trotter; E. J. C. Smither; A. B. Jones, M.B.E., A.F.C.; M. J. Territt, M.B.E.; H. Sullivan; L. C. Lambert, A.F.C., A.F.M.; G. H. A. Newman; L. A. Parr; G. R. Bedford, M.B., Ch.B.; R. O. M. Jones, M.B., B.S.; M. Robertson, L.R.C.P. and S., L.R.F.P.S. (Woman Medical Officer); P. L. Lamb, L.D.S.; D. T. Tate, L.D.S.; J. F. Sanders, B.Sc.; H. M. Shephard and J. R. W. Blyth, A.F.C.

Squadron Officer to Wing Officer, W.R.A.F.: J. A. Bannatyne.

(*To be continued*)

RETURN TO THE FOLD: Ex-members of No. 18 Squadron with the present C.O. and the Station Commander at the unit's recent guest night. Those marked with an asterisk are previous C.O.s. *Front row:* A. V-M. Sir Ranald M. Reid, K.C.B., D.S.O., M.C.,* S/L. R. A. Cooper, M.B.E., G/C. G. I. Carmichael, D.S.O., A.F.C.,* A. Cdre. G. S. Shaw, C.B.,* A. Cdre. H. E. Farrow, C.B., O.B.E.,* and A. V-M. W. A. Opie, C.B.E.* *Middle row:* S/L. J. E. W. Le Gras, S/L. G. Young and F/L. C. H. J. Clampitt. *Back row:* S/L. S. S. Dobbs, W/C. V. Rees D.F.C.,* W/C. G. C. O. Key, O.B.E., D.S.C.,* W/C. D. C. Sandeman, D.F.C.,* S/L. F. Rothwell, D.F.C., G/C. K. W. Niblett, D.F.C.,* W/C. D. C. Smythe, D.S.O., G.M.* and G/C. D. J. P. Lee, C.B., C.B.E., (Station Commander).

No. 11 Sqn. Standard Presentation

A SQUADRON Standard will be presented to No. 11 Squadron by Air Marshal Sir Owen Jones, K.B.E., C.B., A.F.C., B.A., D.I.C., M.I.Mech., F.R.Ae.S., at R.A.F. Wunstorf on August 28th. All former members of the unit are invited to attend the ceremony; those wishing to do so should write to the Officer Commanding, No. XI Squadron, Royal Air Force Wunstorf, B.A.O.R.5, not later than August 4th, giving details of accommodation, if any, required. Visitors should arrive at Wunstorf by 10.30 a.m. on August 28th.

Burma Squadron History

ANY past member of No. 257 (Burma) Squadron who can provide information or illustrations likely to be of use in compiling a squadron history are asked to write to the Adjutant, No. 257 Squadron, R.A.F. Wattisham, Suffolk.

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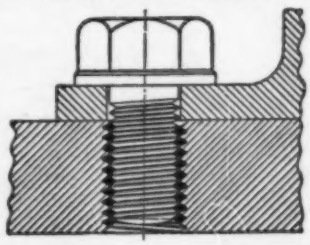

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PUBLIC ANNOUNCEMENTS

AIR TRANSPORT ADVISORY COUNCIL

THE Air Transport Advisory Council give notice that they have received the undermentioned applications to operate scheduled air services.

FROM Lancashire Aircraft Corporation, Ltd., of 7 Berkeley Street, London, W.1:—

APPLICATION No. 310. For a normal scheduled service with Dakota aircraft for the carriage of passengers and supplementary freight between Lympne and Beauvais (Tille) at a frequency of from one to 21 services daily according to traffic demand, during the period from April 1st, 1955 to March 31st, 1965.

APPLICATION No. 311. For a normal scheduled service with Dakota aircraft for the carriage of passengers and supplementary freight between Lympne and Ghent (St. Denis) at a frequency of from one to 21 services daily according to traffic demand, during the period from April 1st, 1955 to March 31st, 1965.

FROM Airlines (Jersey), Ltd., of 4 The Parade, St. Helier, Jersey, C.I.:—

APPLICATION No. 313. For a normal scheduled service with D.H. Heron and D.H.89 aircraft for the carriage of passengers, supplementary freight and mail between Southampton (Eastleigh) and St. Brieuc at a frequency of from one to 14 services weekly, during the period from date of approval to March 31st, 1963.

APPLICATION No. 314. For a normal scheduled service with D.H. Heron and D.H.89 aircraft for the carriage of passengers, supplementary freight and mail between Bournemouth (Hurn) and Dinard at a frequency of from one to 14 services weekly, during the period from date of approval to March 31st, 1963.

THESE applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on July 30th, 1952. Any representations or objections with regard to these applications must be made in writing, stating the reasons, and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 9 Buckingham Gate, London, S.W.1 from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. [2324

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The engagement of persons answering these advertisements must be made through the local office of the Ministry of Labour and National Service, etc., if the applicant is a man aged 18-64 or a woman aged 18-59 inclusive, unless he or she or the employer is excepted from the provisions of The Notification of Vacancies Order 1952.

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APPLICANTS should hold a degree or the equivalent, have a medical standard equal to Class "A" Life Insurance, and should be willing to travel within the U.K. and abroad.

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